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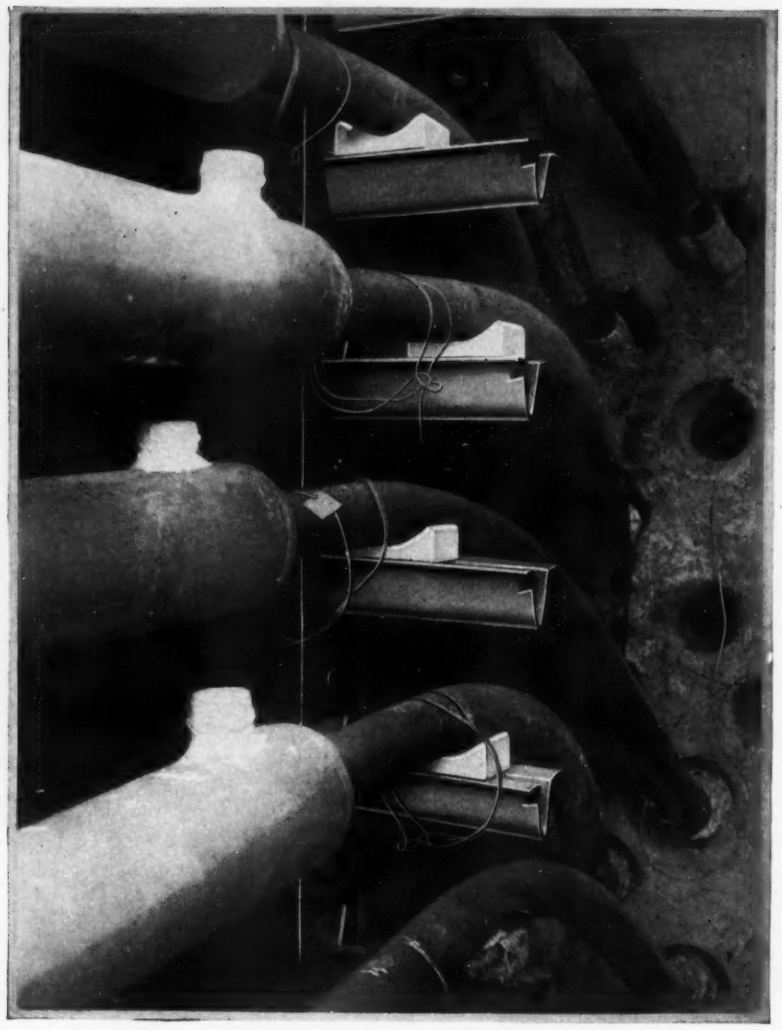

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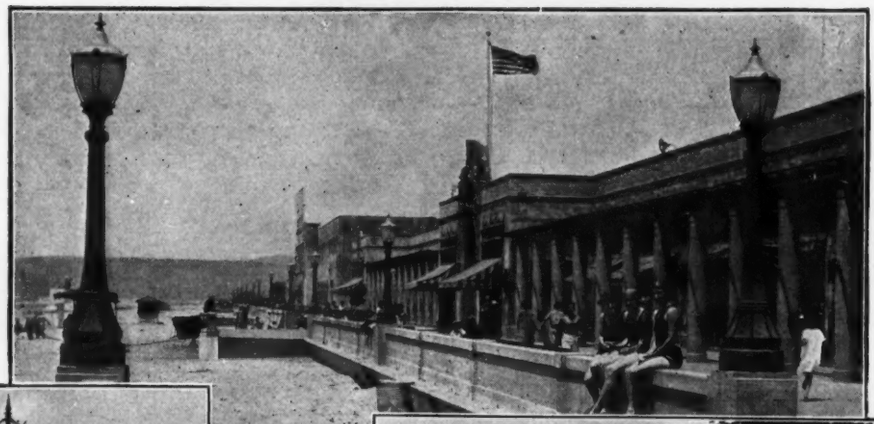

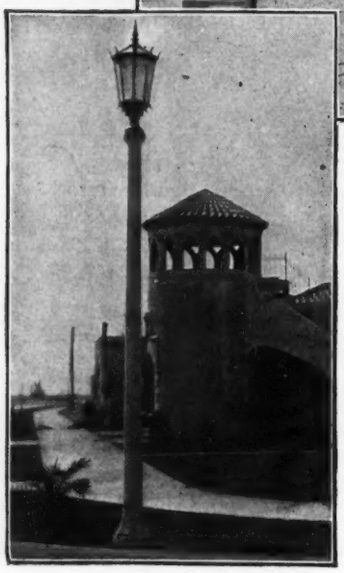

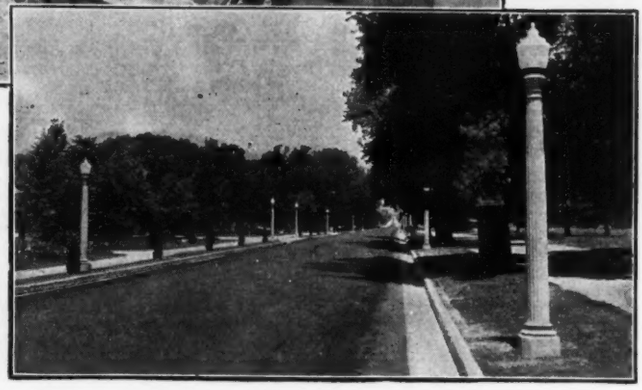

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Electrical World

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Lighting the World

ILLUMINATION was the genesis of the electrical industry and continues to be a great commercial and scientific asset. The production, measurement and intelligent use of electric light is a vital factor in electrical development and in the services that electricity can render for mankind. Therefore the electrical industry should welcome and support the International Illumination Congress to be held at Lake Saranac, N. Y., in the week following September 22.

This is going to be a very practical meeting of the leading lighting specialists of the world. The program deals with automobile headlights, airplane landing-field lighting, street lighting, signal lighting, the influence of light on health and efficiency, highway lighting, factory lighting, school lighting and many other problems. The art and the practice of each country will be presented and discussed, and it may well be that this meeting will start many projects for international standardization in lighting.

In addition to practical application papers there will be technical papers dealing with advances in the art. The problem of light measurement is acute because the carbon-filament standard does not meet the requirements for measuring the illumination values of tungsten-filament, gas-filled and glow-discharge lights. Many committee reports will survey researches in lighting, and the discussions of these technical reports will be replete with suggestions for further researches and for advances in light applications.

Illumination is not static. It is advancing by leaps and bounds, and there are many indications that revolutions in the present practices may be looked for in the future. The industry and all electrical men will do well to keep an eye on lighting, and the American National Committee of the International Commission on Illumination should be congratulated for bringing the Congress to this country at this time.

* * * *

Engineering Contributes to Architecture

ENGINEERING structures can be things of beauty and can contribute a new style to architecture. In a recent book Prof. G. H. Edgell of Harvard, whose department is fine arts and who is dean of the faculty of architecture, pays a splendid tribute to the Cahokia station, across the Mississippi from St. Louis. He says: "Built up from the river in terraces of steel and ferro-concrete, vertically buttressed with great concrete strips that increase in scale with every block, pierced with great verticals of glass and crowned with four pairs of enormous chimneys, it would be difficult to find a more impressive structure. Call it engineering if you will. Gustave Doré would have reveled in it, and the American who, on account of its purely utilitarian purpose, denies it a place in the great architecture of his country is a man of small taste and less vision. . . . It suggests the titanic forces of nature controlled by the genius of man."

Engineers have a sense of beauty, and every good engineering structure, be it power station or machine, conforms to the rules of beauty that govern architecture and sculpture. The modern architecture as exemplified in the skyscrapers and large power stations is a development of engineers as well as of architects, and it is a pleasure to record this splendid tribute of Professor Edgell.

* * * *

Artificial Values Handicap Rate Cases

ENGINEERS and accountants ought to work closely together in establishing valuations for rate-making purposes. If they do not, discrepancies between field costs and estimated costs are liable to make trouble in proceedings before commissions and courts. An appraisal made up by an outside expert has its uses, of course; but if the costs included bear little relation to current outlays for particular classes of work, opposing counsel are likely to concentrate their attack upon the spread between the two sets of figures and perhaps succeed in discrediting a great deal of conscientiously prepared evidence. From an accounting standpoint it is not hard to defend the assumptions of the reproduction-new valuation, but when one tries to check these unit and total costs against the every-day payroll and material accounts of the company, the problem is indeed difficult.

We need not embark on a voyage to the port of an agreed rate base to settle this matter. There are bound to be differences between artificial data and field costs in this class of work, but these discrepancies should be held down to nominal values if possible. On general principles it would appear that it would cost more to build a property piecemeal than to perform the theoretical task of reconstructing it *de novo;* but in a case lately considered the valuation from outside the company exhibited higher costs for the reproduction job. The trained crews of the company were able to do far more work per day as a result of long association and familiarity with the territory served than seemed feasible to the consulted organization, and this led to discrepancies in the unit data making up the rate base which were meat and drink to counsel opposing the company. These differences may be entirely justified by the differences in approach to the valuation problem illustrated in the case,

but they did not make good newspaper copy from the standpoint of public relations or impress the commissioner sitting in the proceedings with the consistency of the company's advocates.

The nub of the whole matter is the importance of the best possible co-operation between all concerned in the preparation of data to be used in controversial proceedings, and it strengthens a company's case surprisingly if unit costs developed out of work orders, invoices and time slips plus overhead exhibit a reasonable degree of parallelism when compared with the estimates of outside consultants covering construction on the same system.

* * * *

Utility Investments Are Sound and Attractive

CURRENT price levels of high-grade electric light, power and communication securities appear to exert little adverse influence upon their purchase by discriminating investors. Buyers of these securities, as of other equities, seek to make money out of their possession. Some ask only for a satisfactory yield upon a stable investment; others hope to make a profit by future sales of their holdings, and others wish to combine these two objectives. The motives and reasoning behind security purchases are as diversified as human nature itself, but the values put upon utility stocks and bonds from day to day in the midst of the present market represent the integrated opinions of countless buyers and sellers who recognize that the electrical industry has graduated to the ranks of financial world power and that it is on its way to still greater triumphs.

The electrical industry is a basic one; the limits of its earning power, based on increasing service throughout the entire world, cannot be controlled or even approximately estimated, and its values stand in the front rank of stability. It is unthinkable that these values will shrink below the danger point if security owners acquire holdings on a sound basis of financing and purchase, regardless of the ups and downs of ticker quotations. If yields diminish, the purchasing power of the dollar should be taken into consideration in relation to the general commodity list. Above the turmoil of multi-million share markets, the electrical industry is expanding with almost incredible strength and speed, and the investor who knows how to appraise values and to control his commitments is sharing the reward which is his due.

* * * *

Ten Years Without Accidents

IF A SINGLE group of men engaged in all the varied occupations of electrical generation, distribution and utilization can go through a period of years without one fatal accident or even one causing loss of time to the man injured, why cannot all of the men engaged in those occupations do the same? For ten years the electrical department of the plant of the American Rolling Mill Company at Middletown, Ohio, has not had a single fatal or lost-time accident. Is there another group of men anywhere in the electrical utility industry that can claim the same record?

In the steel industry there is active executive interest in safety work because no executive can evade the responsibility for accidents to the men under him. Men will be careless until they are made to be careful. Some men will respond to posters and exhortations that lay stress on the clutch of tiny arms, but there are very many who will not. Many men dismiss such "heaven, home and mother" appeals as being stickily sentimental, and they can be made careful men only by the exercise of authority. After they are convinced that safety is a matter that is occupying executive attention and action and is not just the vision of an enthusiastic safety director who means well but has no authority, then the workmen begin to develop a consciousness and spirit in regard to accident prevention that results in something to be proud of. Safety is not the enthusiasm of a day's or a week's campaign in which a man gets "religion" and then falls back later into careless habits; it is not merely the threat of executive displeasure impending over the careless man; it is the working out of a program of company organization whereby every man knows that safety is part of his job—and a very important part; it is the development of a company discipline whereby a desire is created in every man from the president down to keep from having accidents. During the past year a number of the larger utilities have developed departmental safety organization—placing responsibility where it belongs. It is in this direction that progress lies.

* * * *

Chicago Union to Promote More Adequate Housewiring

AN EXPERIMENT is being made in Chicago that should be watched with keen interest by all those who believe that more adequate house-wiring installations can be sold. This is a direct effort by the local union of the International Brotherhood of Electrical Workers to stop the much-complained-of practice among small contractors of talking down the size of jobs to make a lower price. This is done by suggesting to the owner that certain outlets might be eliminated. That the action referred to should have come from organized labor is in itself worthy of note, for this union has thus definitely adopted the policy of making the journeyman responsible for promoting more adequate wiring in the home.

The action taken is both simple and direct. The Master Electrical Contractors' Association of Chicago was asked to call a meeting to discuss the evils of this kind of destructive competition and has passed a new rule to assess a fine against any member contractor who causes the elimination of an outlet from any plan. The penalty will be five dollars per outlet for the first offense and a doubling of the fine for each subsequent offense. Members of the union are to police this new ruling by looking over the plans and reporting wherever a job has been cut or necessary outlets have been left out. Journeymen have been provided with a schedule of minimum specifications—the "red seal" standard—and are instructed to urge the owners to install adequate facilities in the original installation.

The industry has been familiar enough with that misguided policy of labor that strives to string out the job by arbitrary restrictions on the amount of work a man can do. Undoubtedly it has in this way unnecessarily increased the cost of wiring. This new purpose to throw the influence of the union into the promotion of more adequate installations, however, will provide more comfort to the home and is in the public interest as well as

helpful to the electrical industry and to labor itself. It marks a new viewpoint in the union that is sound and constructive, for the prosperity of labor is bound up with the prosperity of the industry in which it works, and it is right that labor should co-operate in the building of the market. It is to be hoped that this idea will prove effective and be adopted in other communities.

* * * *

Why the Disagreements on Clearances?

IN THIS year of grace 1928, with billions of dollars invested in station and transmission equipment, it seems inconceivable that there is no accepted standard or even a reliable recommendation for the separation to be maintained between two conductors of a given voltage or between a conductor and ground, in stations or on transmission lines. Yet we must shamefacedly admit that it is the truth.

Ask station designers how far apart you should keep the busbars in a power house at 13,200 volts or the buses in an outdoor substation at 33,000 volts, and the answers will not agree. Ask any two experienced transmission-line engineers how far you should keep a 66-kv. conductor on a transmission line from ground and you will get two different answers or a lift of the eyebrows and no definite answer at all. Search the whole engineering literature, all the textbooks and handbooks and magazines, and you will find nothing more authoritative on the subject than the opinion of an individual. Ask any manufacturer for a similar recommendation for indoor or outdoor stations, and you will find that the clearances on the equipment which you purchase from him do not at all agree with his recommendations.

Is this not a chaotic state of affairs? Who knows how many thousands of dollars are wasted annually on stations by too great clearances and, on the other hand, how many accidents are caused by too small clearances?

It is not advocated that everything should be so standardized that an office boy should be able to design a station or a transmission line. There are enough office boys doing this work already. There will always be a necessity for a certain amount of deviation from any standard. It will always be necessary to check up on short-circuit stresses in the case of heavy copper, or on the swinging of wires on long spans. But most cases are ordinary, and for ordinary cases there can be and should be standards.

* * * *

Titles, Ltd.

WHAT richer field for the exercise of irony can be found than the realm of human titular distinctions? From age to age the undiscerning have venerated the epaulettes and gold lace of organization while men of achievement have scorned verbal trappings and toiled triumphantly in the strength of their native abilities. This theme was ever dear to the creative genius of Gilbert and Sullivan, and today those competent to look below the surface in any walk of life can find plentiful opportunity to draw the deadly parallel. None the less, an optimist will assert that, in spite of all this, titles are essential to successful co-operative enterprise. And they are.

At a recent meeting of thirty central-station power sales engineers it appeared that six of these useful specialists hold office without portfolio, as it were. In another case a lighting department head functions as sales manager, or did until recently, without appropriate designation. In still another instance the office of commercial manager seems to reside in the lower right-hand drawer of the vice-presidential desk, and in another the assistant to the president is known to the outside world as a leading clerk.

A large syndicate recognized this point not long since when it appointed one of its leading valuation and rate engineers a vice-president of the operating division. In themselves titles are "as sounding brass or a tinkling cymbal," but when properly fitted to spheres of duty they are useful tools. Indeed, they often embody ideals of service which stimulate the best efforts of their holders

* * * *

Design Underground Systems for the Future

UNDERGROUND conduit construction is expensive and to the extent that it only replaces existing overhead facilities is largely unproductive of additional income. Once underground cables are installed in a street, it is impossible to revert to overhead wires, no matter how great the need. After the underground structures have been completed, they can be enlarged only at a cost comparable with the total initial expenditure. The increment cost of additional ducts and of larger manholes at the time of original construction is small compared with the cost of subsequently digging up a line to build more ducts and the cost of demolishing manholes already full of cables to permit of enlargements.

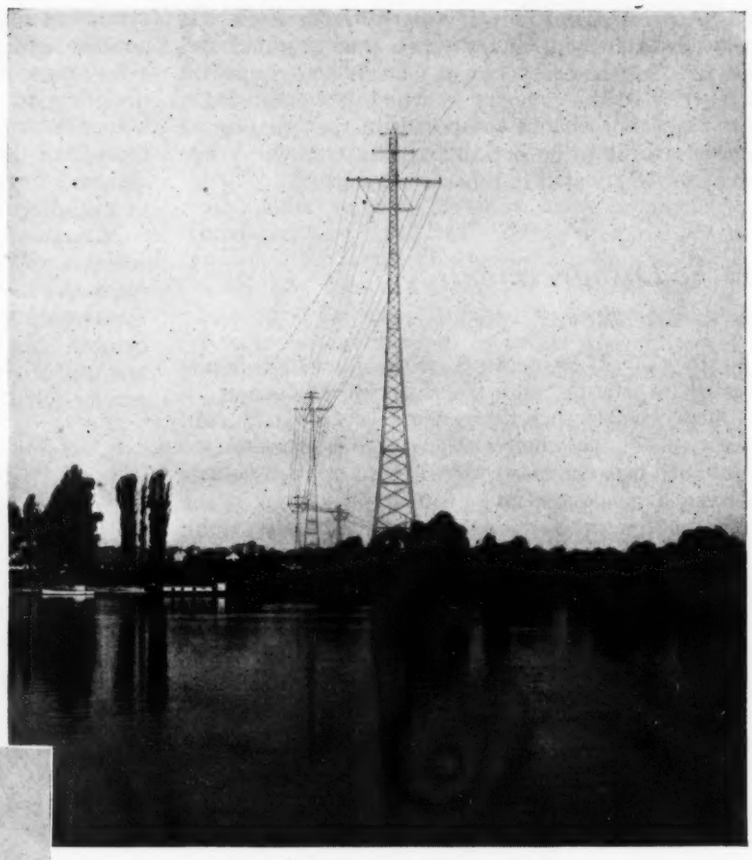
This inflexibility of underground conduits may not become apparent for the first few years following construction. New systems are usually built with a few extra ducts—more than some persons can see any possible future use for—and the cables that are installed have larger capacity than the overhead wires. Everything seems in excellent shape for many years to come. However, the extra ducts are used up almost unconsciously. An extra primary for some new customer, a new street-lighting circuit, a new set of wires for traffic control or any one of a number of unexpected developments will reduce spare facilities almost without any one realizing it.

It is this rapid development in the use of cables that has an important bearing on the present-day design of duct lines and manholes. These conditions make it imperative that the design of underground system be placed in the hands of engineers who are not only equipped to judge the present and future requirements of the system but are also thoroughly appreciative of the limitations of their knowledge. Then, when the question of constructing extra ducts is under consideration, they may demonstrate that adequate provision should be made for future conditions that are at the moment far beyond the expectations of the engineers and executives.

Conduits and manholes should be constructed for an expected life of at least fifty years. If maximum capacity, both in number and size of ducts and size of manholes, is provided at once, the occasion to reconstruct the line is unlikely to arise. While the first cost will be larger than the immediate load will justify, the saving that will result from having reserve facilities available when needed will in the end pay large dividends on the initial cost.

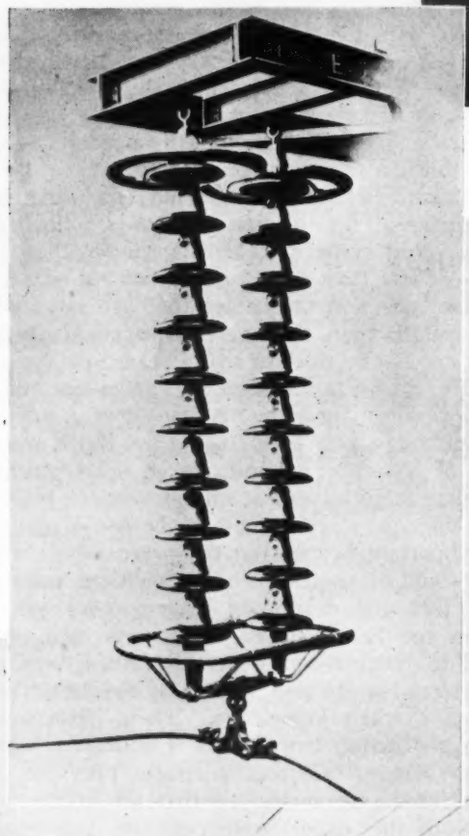
220,000-Volt Line in Germany

The first 220,000-volt line in Germany connects steam plants at Cologne, Coblenz, Mannheim and Württemberg to the Alpine power resources.

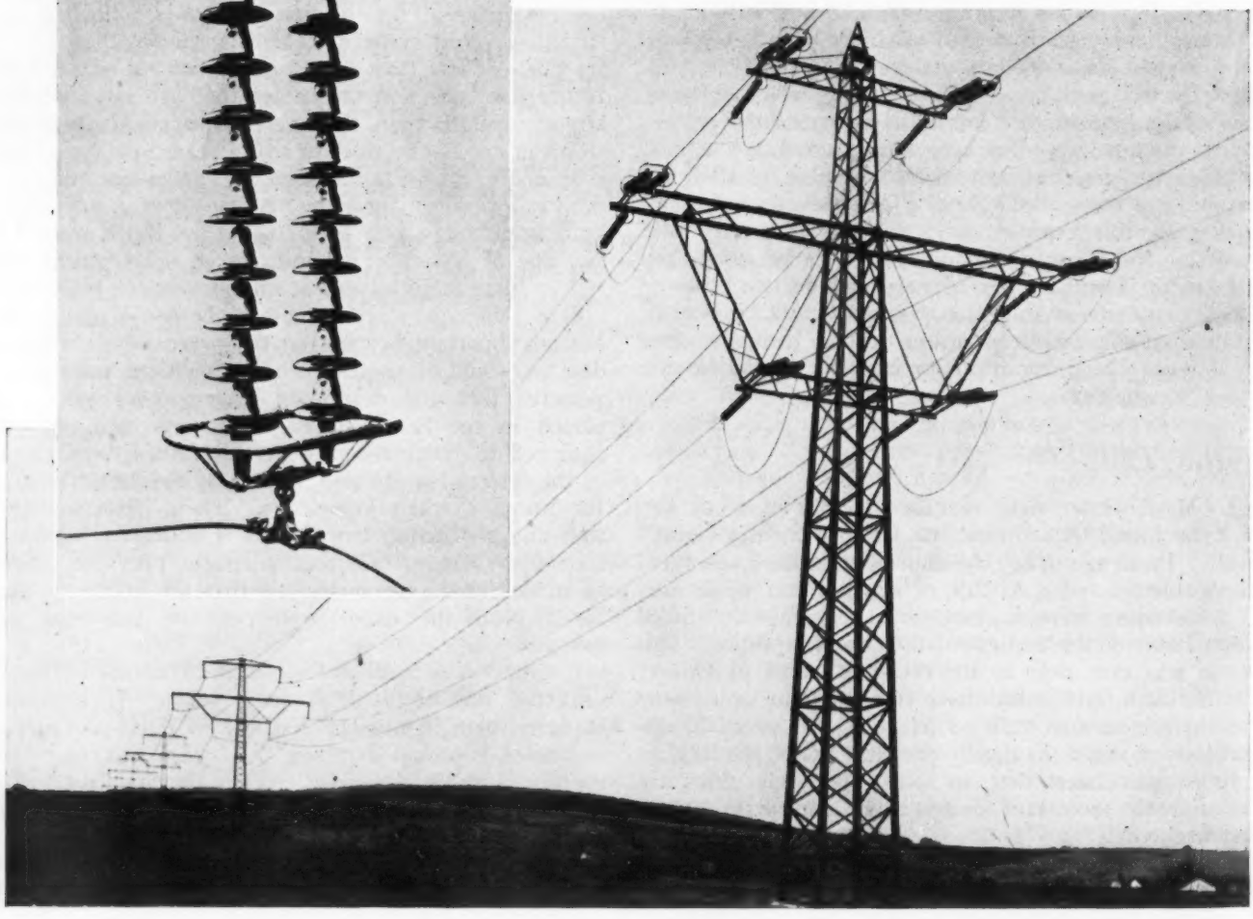


Rhine crossing near Coblenz

Details of the 220,000-volt insulator arrangement



General view of 220,000-volt line



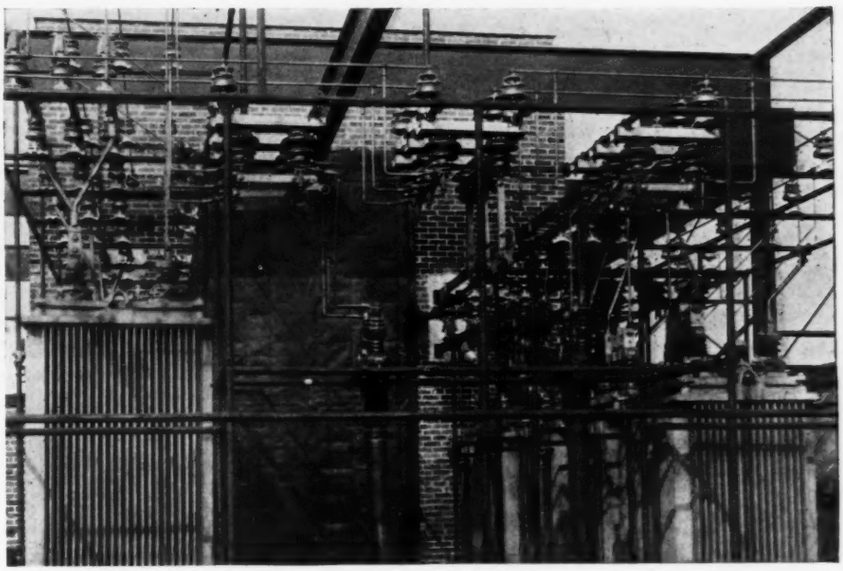
Uninterrupted Flexible Service
in Industry

The way in which this requirement has been handled by the layout of power supply and delivery equipment in an automobile plant is discussed

By JIM J. ORR
Electrical Engineer Oakland Motor Car Company, Pontiac, Mich.

IN THE design and layout of the electrical system for the new Pontiac plant of the Oakland Motor Car Company there were three major considerations. The first was to provide every insurance for continuous power to all parts of the plant. Uninterrupted service is especially important in a plant where every operation is timed to fit into a complicated scheme of production. A delay even in some small department may result in shortages which will cause expensive shutdowns on the assembly lines.

The second consideration was to make the system so flexible that it would readily lend itself to sudden changes in load locations and to extensive additions for future expansion. Developments in the automotive industry are so rapid that new units may be added at any time. Changes in methods of manufacture sometimes cause the relocation of a whole department or group of departments. This must be accomplished in a very short time. These conditions require that the electrical system be designed to accommodate changes without delay and without excessive expense.



Transformers on roof of motor plant

Cables from main switch station in front. Above are disconnect switches for transfer of cables in case of a failure. Overhead rail for traveling hoist to handle transformers. Within the inclosure shown are generator and lighting control panels, automatic transformer switching and protective relays, control battery and charging generator and truck-type distribution breakers. A trapdoor in the floor may be removed to lower transformers and circuit breakers for repairs.

The third objective of the layout was to obtain economical use of power. The annual power bill is an important item in the cost of the manufacture of automobiles and the electrical system must be so designed that all possible savings can be effected. With these things in mind the layout for the present system was made. A one-line diagram of the system is shown.

POWER SUPPLY

Power for this plant is obtained from the Rundel Street substation of the Consumers Power Company at 4,800 volts over three overhead lines on steel poles. Pole-top, horizontal air-break switches are used for disconnects ahead of the main switch station. This station is situated convenient to the motor plant and the main assembly building and is the center of the system. A double bus system is used. Switching equipment is of the safety, inclosed, truck type. A steel housing incloses the main bus, primary disconnects and also accommodates the truck-mounted oil circuit breakers. A steel superstructure incloses and supports the secondary bus and disconnect switches. Transfer switches are accessible through doors on the front of the superstructure. A truck breaker is not removable except when breaker is open. Cable terminals, instrument transformers and auxiliary switches are all inclosed in the housing.

A spare truck breaker which will fit any of the housings is carried, making possible repairs and adjustments to the circuit breakers at all times, without serious interruption of service. This type of switching equipment is especially adaptable to industrial plants where highly skilled maintenance men are not available at all times. The average factory electrician knows a great deal more about control devices, cranes, motors, etc., than he does about switching equipment.

The present switch structure occupies one side of the building. Space is available for four additional breakers along this side and provision is made for a similar installation along the other side in case of additional

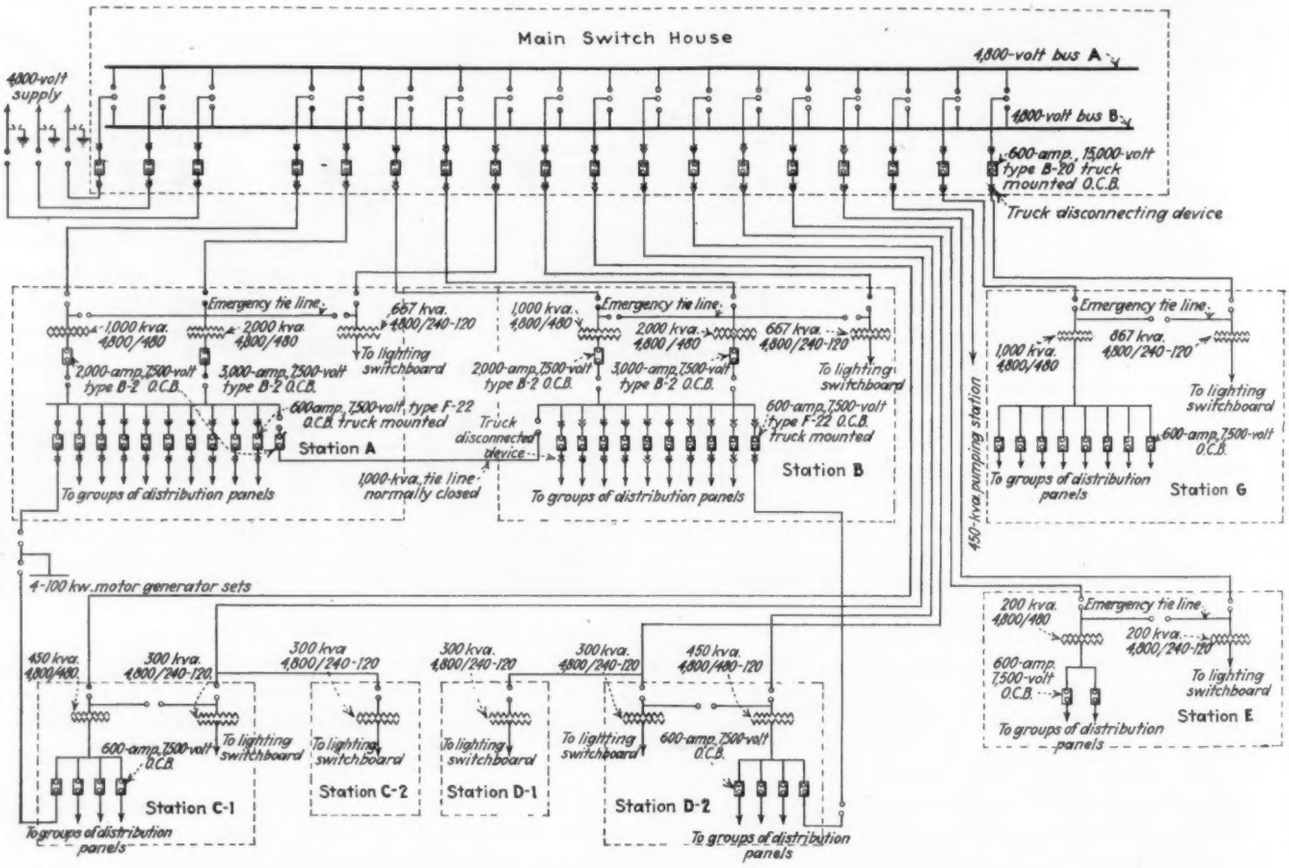
large units. The housings are supported on steel rails and the rear compartment is directly over a cable trench. Cables pass out of the bottom of the housing into the trench, then to the underground ducts to the plants. Metering equipment is mounted on separate steel panels. A floor plan of this station is shown in the accompanying diagram. Incoming lines are metered by duplex indicating and integrating meters. Kilowatts and reactive kilovolt-amperes are recorded on a chart and watt-hours are integrated. Incoming truck switches carry indicating ammeters and power factor meters. Each outgoing line is equipped with indicating ammeter and watt-hour meter.

Transformer Substations at Load Centers

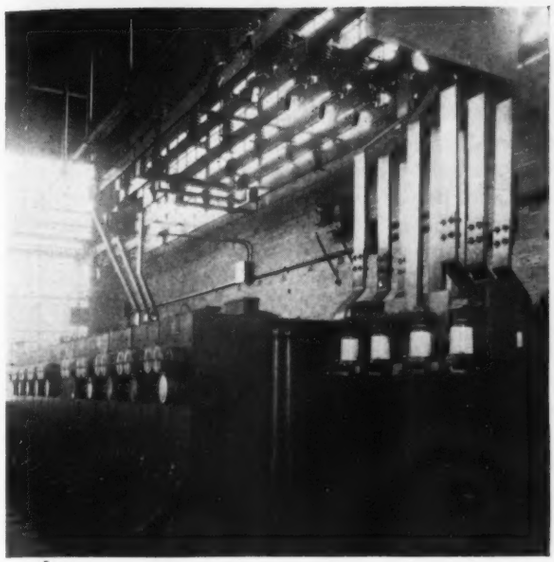
There are eight transformer substations in the plant, located at points near load centers. To obtain a maximum of flexibility, lighting and power transformers are in the same stations, but fed over separate cables. Cables are of such size that in cases of emergency power banks can be operated over the lighting cables and *vice versa*. Bus racks in the stations are arranged so that transformer switches provide a quick means of changing banks from one cable to another. A pothead or cable failure would only shut a bank down for a few minutes while switching was accomplished. The writer knows of instances where loss of production due to cable failures has cost many times the extra investment in this system.

The most interesting installation is that in the motor plant. The load density in this plant is very high, most of the area being occupied by heavy machine operations. At times of heavy production every machine is operated almost constantly at full speed. This condition makes it necessary to have transformer capacity almost equal to the connected load. At other times, when the schedule is light, one operator runs two or three machines and the load is correspondingly low. At night and on Sundays the only load is that caused by a few pumps, fans, etc. There is a large part of the time when only a small part of the installed capacity is needed. In order to reduce the cost of losses in transformers it was considered advisable to remove as many banks from the line as can be spared at any time. For this reason each of the two substations in this building has two power banks, one of three 667-kva. transformers, the other of three 333-kva. transformers, all 4,800/480 volts. The substations are located on the roof 500 ft. apart. A 1,000-kva. tie line connects the 480-volt bus of the two stations.

The automatic transformer switching equipment is arranged to operate the transformer banks as load demands and emergencies require. Under normal operation, with minimum load on the system, the 1,000-kva., transformer bank in station A is the only bank on the line. The load on station B is fed over the secondary tie line. Under this and all normal conditions the tie breaker is closed. With an increase of the load beyond the capacity of this transformer bank, additional transformer banks are brought on the line in steps of 1,000 kva. capacity in stations A and B, depending upon whether the additional load requirement is centered on station A or station B. When a 2,000-kva. bank is cut in a 1,000-kva. bank drops out until called back into service by additional load. This cutting in of transformer banks is continued, as the load requires, until the total capacity of the stations is made available. Likewise on load decreases, the various transformers are cut out of service in 1,000-kva. steps until a balanced



Power supply for Pontiac automobile plant laid out to give continuous flexible service



Solenoid-operated transformer switches and truck-type switchboard in station A

condition is restored, and then only such transformer capacity as is needed is connected to the load.

Differential protection is provided for each bank of transformers. In case a bank is removed due to internal faults it is locked out of service and such other transformers as are needed to supply the load are brought on the line. If, for any reason, the tie line becomes overloaded, the tie breaker is opened and locked out of service and each station takes care of its individual load automatically. If at any time there is a call for more transformer capacity than is available an alarm is established. The automatic features of the switching are operated on the high-tension circuit breakers, the low-tension breakers following the action of their governing high-tension breaker. Lockout relays on each of the transformer banks provide alarms to indicate that a bank is out of service. At all times the capacity is such that the combined losses are at a minimum consistent with the load. This results in a marked saving.

The arrangement of these stations is shown in the accompanying illustrations. Disconnect switches provide a means of operating any bank over any one of the cables in an emergency. The lighting cable is of such size that it will handle either of the power banks if necessary. The transformers are mounted on wheeled trucks and can be readily removed to a point under an overhead hand hoist. A section of the floor in each station is removable, allowing transformers to be lowered to the main floor for repairs.

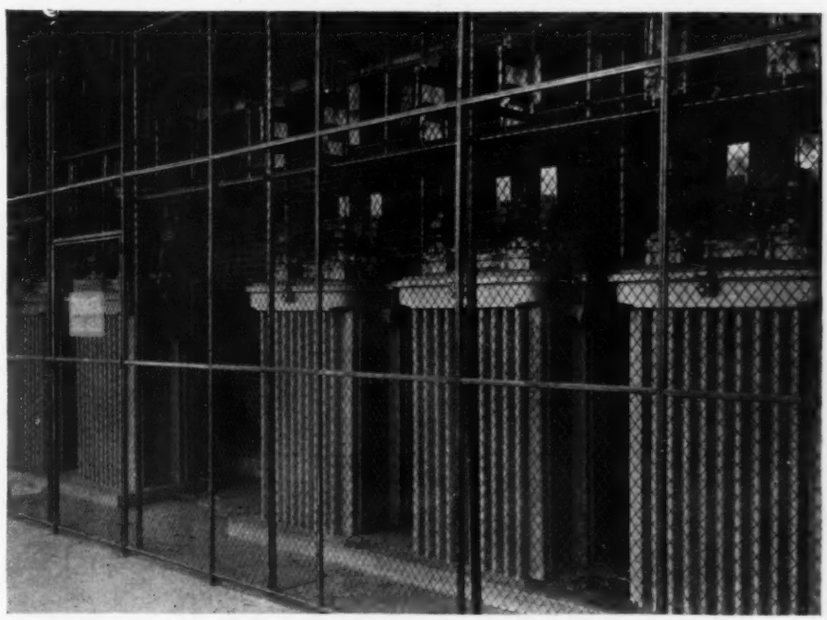
Switching equipment in these stations is also of the inclosed truck type. The circuit breakers are rated 600 amp., 7,500 volts. Each breaker handles a line of power panels across the building. A spare truck breaker of this type is also carried. Each truck carries, besides the circuit breaker, current transformers, disconnecting devices, ammeter and watt-hour meters. These watt-hour meters provide the basis for allocating power costs among the departments.

Distribution and Testing Facilities

The final distribution point is a ten-circuit power panel of the convertible type, especially designed for this installation. A power panel is mounted overhead at each column of the building. This provides ten motor circuits at the corner of every 30-ft. x 40-ft. bay. Each circuit can be fused either 30, 60, or 100 amp. Individual circuits are brought into a pull box directly beneath the power panel. A rigid sheet metal trough with hinged cover is run from column to column attached to each power panel. This trough is provided with knockouts at 6-in. intervals in the sides and bottom.

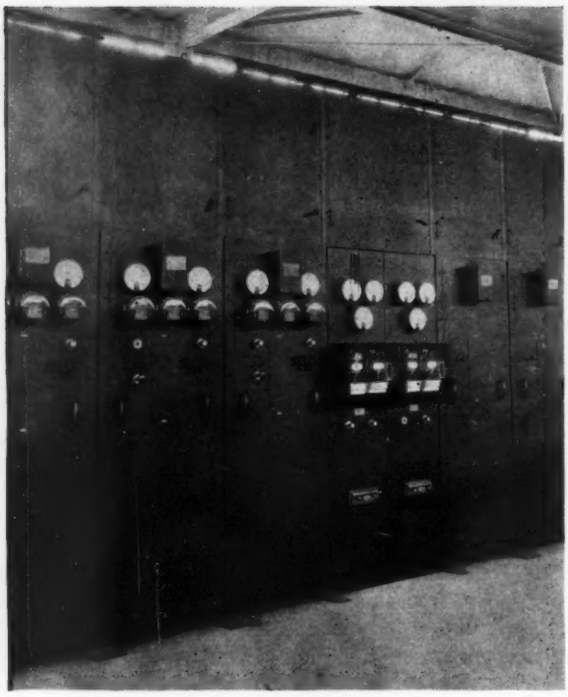
When a machine is installed, conduit is run directly up from the starter to the height of the trough and then a horizontal run to the trough. One of the views shows the arrangement of power panel, pull box and troughs. The wires are laid in the trough from the pull box to the conduit and then down to the machine. Only one fitting is required. Threadless fittings are used on these installations. The safety switch and motor starter are mounted directly on the machine. This system has resulted in a large saving in installation costs. Cost of relocation of machines is even further reduced. The motor, starter and switch go with the machine to the new location. The wire is taken out of the trough and the short horizontal run of conduit is all that has to be changed, the trough being at the same height throughout the plant.

Each machine is equipped with its individual motor. Magnetic contactors with push-button control are used throughout. Reduced voltage starting is used only on motors of 50 hp. and above. A non-fused disconnect switch is used ahead of each starter. Thermal overload



Transformer installation serving assembly plant is typical of others

Contains 450-kva. power bank and 300-kva. lighting bank. A neutral tap is brought out of both the lighting and power transformers, making them interchangeable. This size has been standardized for all small stations, giving a maximum of flexibility. Circuit breakers and lighting control switchboard are inside of the brick building. Either lighting or power bank can be operated over either of the cables. Carbon tetrachloride fuses are used on the primaries of the transformers where differential protection is not provided and offer satisfactory safeguards.



Truck-type switches set over cable trench to facilitate changes

Cable trench can be uncovered by removing floor plates. Spare truck can replace any unit. All lines are equipped with test terminals arranged for ready use.

protection is provided for each motor; this feature is given special attention by electricians. It has been found that no single item will go so far in preventing burnouts as accurate setting and constant attention to the overload relays.

The power panels are so built that a test jack is provided for each individual motor circuit. Periodic testing of motors is so important that it was considered necessary to provide a safe and quick means for accomplishing a test. The test plug is inserted through openings in the door of the power panel without interruption of service to the machine. Testing instruments and transformers are mounted on a small cart and can be taken to any power panel quickly. The test man can obtain a record of all the machines on this panel by merely shifting the plug and adjusting the transformer ratios. The operator of the machine in most cases is not aware that his machine is being tested. The results are better because an operator will almost invariably speed up or slow down when he knows his machine is under test. The records obtained from these tests are used for analyzing mechanical troubles, time study, etc., as well as for electrical purposes.

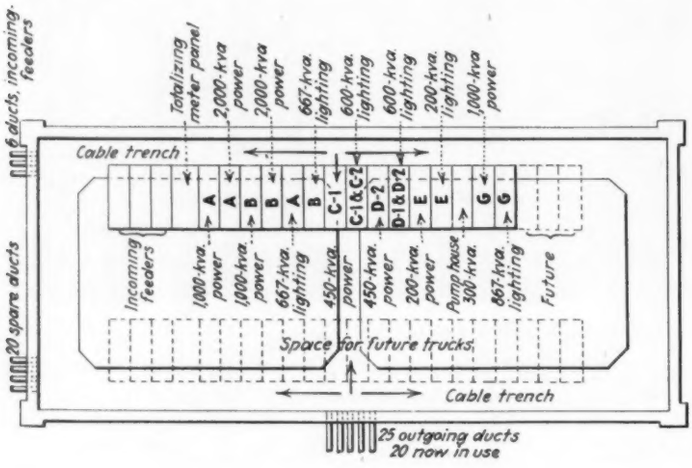
Power distribution in the assembly plant is from four substations located on the docks. Station C-1 is typical of these stations. The load density in this plant is not so high and power panels are more widely scattered. Changes and moves are not so prevalent in an assembly plant as in a machine shop, and it is not necessary to cover the area so thoroughly. However, reliability of service is even more important. An assembly line turning out a car every 40 seconds must be kept going at almost any cost. For this reason every precaution is taken to prevent interruptions. The same dual cable system is used here as in the motor plant. In addition, secondary tie lines are provided between stations so that important motors, such as those driving conveyors, pumps, etc., can be kept going in spite of a station shutdown.

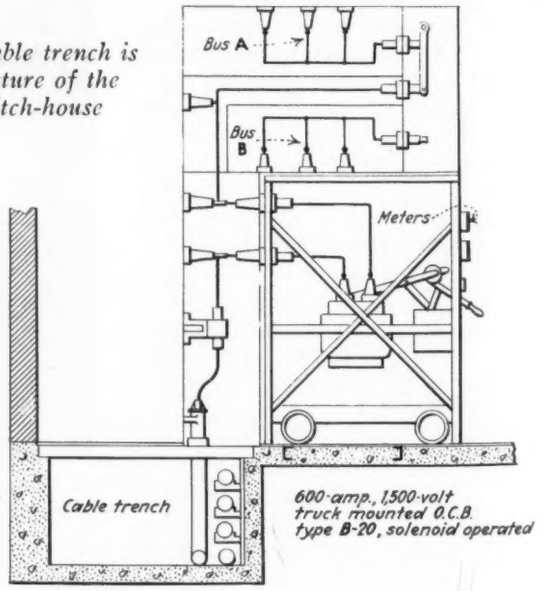
Use of Special Circuits

Direct current at 250 volts is used throughout the plant for cranes, hoists, trolley cars, etc. At a central point between the motor plant and the assembly building are two synchronous motor-generators which supply the direct current. No fuses are used on the direct-current system. Circuit breakers in the station protect the main distribution lines and small circuit breakers protect the individual installations. Separate generators supply the power for magnetic chucks. A battery is floated across these sets to prevent a sudden loss of power causing revolving work to be thrown off and resulting in possible injuries.

In this same station are the motor-alternator sets, which supply three-phase, 180-cycle power at 220 volts for the operation of "Hi-cycle" tools. These tools are used exclusively on the assembly and sub-assembly lines. They are very useful as screwdrivers, nut-setters, portable grinders, etc. We find that maintenance costs for this type of tool are about 50 per cent less than that of maintaining the universal tools of the same type. Outlets for the distribution of this power are located at regular intervals along all assembly lines. Circuit breakers are provided for each branch circuit and we have

The cable trench is a feature of the switch-house





found it advisable to install duplicate lines of outlets, with separate circuit breakers along each assembly line to facilitate the use of energy

Power for the generator station is supplied from station A. An auxiliary line from one of the substations in the assembly plant supplies the station in an emergency. The station bus also serves as a convenient tie for providing emergency power to the assembly building from the motor plant stations.

Illuminating Equipment

Lighting circuits are all three-wire, 240-120 volt, with grounded neutral. The lighting panels are controlled from substations by fused knife switches mounted back of steel panels with front control. Lighting in the assembly and shipping buildings is almost entirely incandescent. The main assembly floor is lighted by 750-watt "X-Ray" units, mounted 60 ft. above the floor, and 500-watt, deep-bowl angle reflectors on the sides of balconies. The average illumination in this area is 12 foot-candles. All walls, columns, ceilings, etc., are painted flat white.

Spray booths and paint rubbing rooms are illuminated by Cooper-Hewitt lamps. To eliminate any danger of explosion in the spray booths we have hung the auxiliaries for the mercury lamps in banks, about 40 ft. from the spray booths. The tubes and reflectors are mounted over the spray booths and wired to the auxiliaries with $\frac{3}{32}$-in. rubber-insulated wire. This type of lighting seems to be very effective for paint spray and rubbing. One of the chief advantages is that "highlights" in the polished surfaces are eliminated to a large extent. This is a particularly desirable characteristic for paint shop illumination.

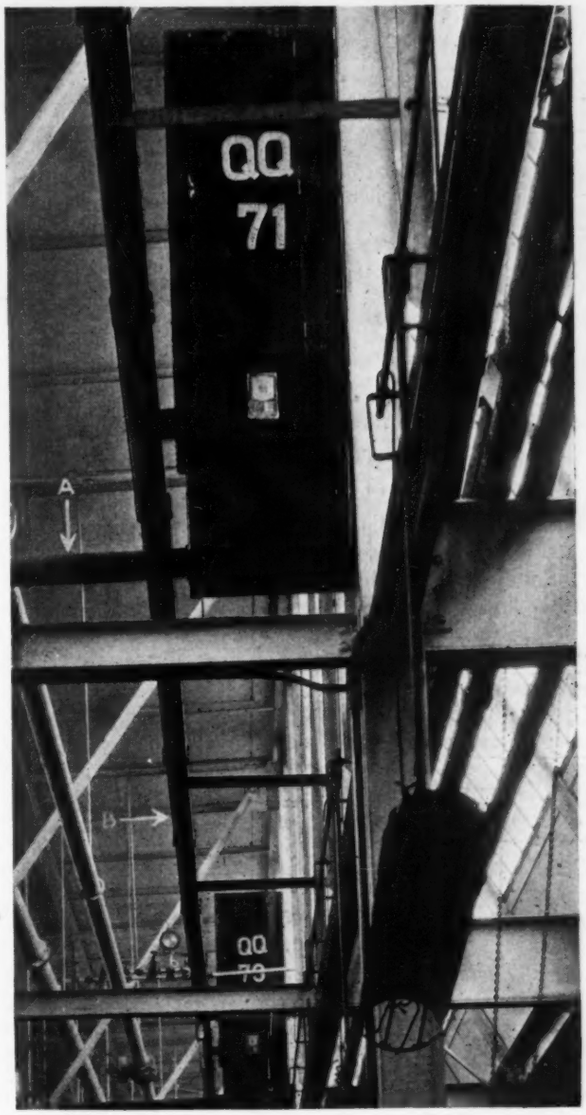
The machine shop is lighted entirely by mercury lamps. These are hung on 13-ft. x 15-ft. centers. The mounting height is 9 ft. 6 in. There are 1,800 lamps in this one room, lighting an area of 400,000 sq.ft. In spite of the size of this installation and the fact that fine machine operations are scattered over the floor we have never been asked to move or change a light, nor have we heard any complaints of the lighting. Production efficiency of the night shift has been fully equal to that of the day shift.

All elevators in the plant are the direct-current type. A separate motor-generator supplies power for each machine. Speed control is on the field of the generator. This type of control has been very satisfactory and particularly free from trouble. During nine months of operation it has not been necessary to replace any parts whatever and there have been no repairs. Self-leveling equipment is the "main-motor-micro" type and offers speedy operation with minimum maintenance.

Daily Inspection of Motors

Maintenance of this system is largely a matter of constant vigilance for conditions which may cause trouble. We use a regular schedule of routine inspection. Every motor is inspected every day. This in itself is quite a task. There are 1,700 motors in the machine shop alone. Each inspector is assigned a district, for which he is held responsible. He notes condition of bearings, oil, gap, leads and insulation. He examines the starter, paying strict attention to relay setting and contactor condition. Periodically he examines the fuses. At all times he is on the alert for conditions which will lead to breakdowns.

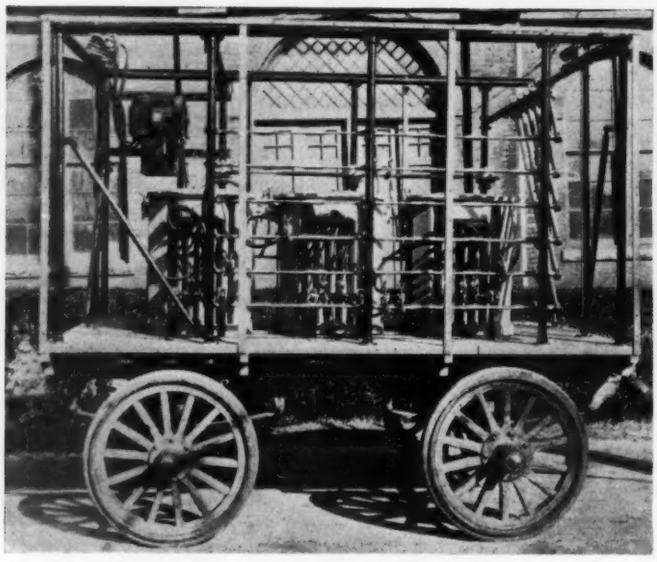
A special inspector is held responsible for the mechanical and electrical condition of hoists. Another inspector looks over each crane every day. Elevators are inspected daily by our man and monthly by the manufacturer's representative. All this inspection is backed up by a periodic check by a foreman. The daily trouble sheet forms an automatic check on the inspectors. Every reported breakdown is immediately investigated to determine whether it could have been prevented by better maintenance. If any inspector has been negligent the fact is at once evident. By thoroughly carrying out every detail of a carefully planned system of inspection we have done much to prevent costly burn-outs and hold-ups.



Method of mounting and feeding power panels and pull boxes

Connecting the power panels (QQ 71, etc.) are rigid metal troughs (B), in which are run the circuits to the individual utilization devices. Knockouts in the bottom permit connecting a conduit at any place and thereby permit flexibility of layout. The feeder circuits to panels are run in conduit (A).

We have tried to design, build and properly maintain an electrical system that would give real service at a minimum, consistent cost. Much has been accomplished, but there is still a great deal more to be done.



Trailer-mounted substation minimizes interruptions on distribution circuits

Portable Emergency Substation Improves Service

A PORTABLE transformer substation designed to take care of small power, range or lighting customers who are temporarily deprived of service due to any transformer trouble that may occur after regular working hours, has been placed in use by the Southern Public Utilities Company.

The necessary equipment is mounted on a truck trailer so arranged that it can be towed to position by any truck and put in operation by one lineman, according to W. B. Ellis, Jr., manager of the Greenville branch of that company. The substation consists of three 25-kva., single-phase, 2,300 to 110/220-volt, distribution type transformers with busbars so arranged on the high side as to give either single-phase, three-phase open delta or three-phase closed delta connections. The buses on the low side are six in number and permit the delivery of single-phase, 110-volt, two-wire; single-phase, 220-volt, three-wire or three-phase, 220- or 110-volt three-wire connections. These are obtained by the use of clamp connectors on the end of the transformer leads, using copper pipe for the busbars.

The connections to the line are made from a regular service rack on the station. The primary line goes directly into a three-phase automatic oil circuit breaker and it is further protected by transformer fuses in this circuit.

The whole station is protected by sheet iron on four sides and a door is constructed in the rear with a lock. The portable substation is credited by Mr. Ellis with

Characteristics of Some Southeastern Systems

Table I—Proportion of Fuel and Hydro Plants and Relation of Generated to Purchased Output

Southeastern Power & Light Subsidiaries

Name of Company	Fuel-Burning Plants: No. of Plants	Fuel-Burning Plants: Rating of Generators, Kilovolt-Amperes	Hydro Plants: No. of Plants	Hydro Plants: Rating of Generators, Kilovolt-Amperes	Generated and Purchased Output, 1927: Total Output Kilowatt-Hours	Generated Kilowatt-Hours	Purchased Kilowatt-Hours
Alabama Power Company	13	(a) 108,654	5	254,700	1,759,143,119	1,178,502,222	580,640,897
Georgia Power Company	24	(b) 28,272	19	214,960	697,306,888	329,829,017	367,477,871
Macon Companies†	2	(c) 3,750	1	18,000	143,636,481	47,125,600	96,420,881
Mississippi Power Company	16	(d) 30,587	..	.....	75,389,189	22,040,895	53,346,294
South Carolina Power Company	1	23,750	..	.....	33,405,030	33,363,780	41,250
Gulf Power Company	4	(e) 3,965	..	.....	17,395,515	584,886	16,810,629
Mutual Light & Water Company	1	(f) 625	..	.....	2,285,284	.....	2,285,284

†Including Central Georgia Power Company
(a) 265,800 kva. available by lease or contract.
(b) 17,250 kva. available by lease or contract.
(c) 12,500 kva. available by lease or contract.
(d) 805 kva. available by lease or contract.
(e) 1,460 kva. available by lease or contract.
(f) 1,875 kva. available by lease or contract.

Table II—Energy Consumption per Customer for Different Classes and Segregation of Output

(Southeastern Power & Light Subsidiaries)

Name of Company	Total Customers	Kilowatt-Hour per Customer: Residential	Kilowatt-Hour per Customer: Commercial	Kilowatt-Hour per Customer: Power	Segregation of Total Output in Per Cent: Residential	Commercial	Power	Municipal and Street	Other Utilities	Other Sales	Intra-Company	Losses
Alabama Power Company	88,748	420	1,340	135,000	1.5	1.2	39.2	0.6	41.3	0.03	1.5	14.7
Georgia Power Company	84,363	453	2,850	57,900	4.3	5.9	43.5	0.9	18.3	0.1	10.2	16.8
Macon Companies	10,685	395	4,220	190,000	2.5	2.9	60.0	5.7	10.4	0.1	3.4	15.0
Mississippi Power Company	29,431	337	1,250	21,000	9.6	9.7	49.3	2.7	2.5	0.3	5.3	20.6
South Carolina Power Company	10,421	372	1,780	27,800	8.7	11.3	43.1	3.9	2.1	1.2	13.7	16.0
Gulf Power Company	8,819	340	1,230	13,600	12.4	12.3	42.5	3.1	....	4.1	9.2	16.4
Mutual Light & Water Company	2,107	217	1,440	3,500	15.7	21.5	18.2	6.4	2.4	....	13.3	22.5

considerable time saving, as the regular trouble man can install and put it in operation in a fraction of the time required to hang a transformer.

Copper per 1,000 Kw. a Basis for Low Annual Cost

A rough check for periodically determining whether direct-current networks are designed for minimum yearly cost

By H. L. Wallau
Electrical Engineer
Cleveland Electric Illuminating Company

AN EXTENSIVE network does not lend itself readily to the economic determination of the proper proportions to yield minimum annual cost. Much must be left to the judgment of the designer. The following analysis is suggested as a means of establishing a "yardstick" which may be rapidly applied to an existing system at the close of each year, to determine whether the copper installed per 1,000 kw. of delivered load is of approximately the right magnitude for minimum annual cost and for comparison with previous years. To this end an arbitrary representative feeder is selected, of a cross-section and length typical of the network to be analyzed. In the figures set up below a ½-mile, two-wire (1 mile of cable), 2,000,000-circ.mil feeder has been selected as a standard and subsequent determinations referred thereto.

Assumed Causes of Periodic Copper Increase

The greatest increases are usually feeder increases.

Service Mains: By the taking on of new buildings or increases in loading of existing buildings.

Street Mains: By extensions to new streets not previously served, occasionally by replacements of existing by heavier mains in districts already served.

Feeders: By load growth, usually coupled with the installation of new substations, or of additional conversion units in existing substations.

The "yardstick" to be used is the theoretical number of equivalent feeders per 1,000 kw. in comparison with the equivalent feeders as determined in Table I. This theoretical number is, of course, that which yields the lowest annual cost.

To this end, let

K_1 = Kilowatt-hours delivered for use annually.
K_2 = Kilowatt-hour annual loss.
V = Outer wire voltage maintained at service switches.
A = Average amperes delivered.
P = Average load in kilowatts.
p = Average loss in kilowatts.
R = Equivalent network resistance, ohms.
N = Number of equivalent ½-mile 2,000,000-circ.mil feeders in parallel.
T = Number of equivalent ½-mile 2,000,000-circ.mil feeders per 1,000 kw.
8,760 = Hours per year.
0.0285 = Resistance of 1 mile of 2,000,000-circ.mil cable in ohms.

Then

$P = K_1/8760 \quad p = K_2/8760 \quad A = 1000P/V \quad R = 1000p/A^2$
$N = 0.0285/R \quad T = 1000\ N/P$

T may also be expressed as follows:

$$T = 28500\ K_1/K_2\ V^2 \qquad (1)$$

which is the more convenient form.

It is unnecessary to set up Tables I and II in applying the check. T is calculated from equations (1) and (2), using the proper numerical values for the network being checked, as found from statistical and cost records. The tables were set up in this discussion to emphasize the fact that the annual cost increases quite rapidly if the amount of feeder copper is low with consequent high direct-current bus and heavy losses.

TABLE I—LOAD, LOSS AND FEEDER COMPARISONS

	Year			
	First	Second	Third	Fourth
Mean service voltage	230	230	230	230
Kilowatt-hours delivered	80,000,000	90,000,000	100,000,000	110,000,000
Kilowatt-hours loss	12,500,000	11,000,000	14,000,000	11,850,000
Average load, kilowatts	9,140	10,250	11,440	12,550
Average loss, kilowatts	1,428	1,255	1,600	1,355
Average current, amperes	39,700.	44,700	49,800	54,600
Average network resistance	9.07×10^{-4}	6.28×10^{-4}	6.45×10^{-4}	4.55×10^{-4}
Number of standard feeders in parallel equivalent to network resistance	31.4	45.4	44.2	62.7
Equivalent feeders* per 1,000-kilowatt load	3.44	4.43	3.87	5.00

*The number of equivalent parallel feeders per 1,000 kw. of load has been calculated on a unity load factor basis. It is, however, independent of load factor.

TABLE II—COMPARISON OF ANNUAL CHARGES

	Year			
	First	Second	Third	Fourth
Equivalent feeder per 1,000 kw. from Table I	3.44	4.43	3.87	5.00
*Annual loss kilowatt-hours per 1,000 kw.	1,375,000	1,065,000	1,220,000	945,000
Fixed charges and maintenance at $2,155 per feeder	$7,410	$9,560	$8,320	$10,775
Loss value at 1 cent per kilowatt-hour	13,750	10,650	12,200	9,450
Annual cost per 1,000 kw.	$21,160	$20,210	$20,520	$20,225
Theoretical equivalent feeders required per 1,000 kw.	4.7	4.7	4.7	4.7
Annual cost per 1,000 kw.	$20,185	$20,185	$20,185	$20,185
Difference	$975	$25	$335	$40

*Annual loss per equivalent feeder equals 4,726,000 kw.-hr.

Note that N and T are quite independent of the actual number of feeders installed and are determined from the average network resistance.

Let

I = Investment per mile of 2,000,000-circ.mil cable, including conduit.
r = Rate at which fixed charges are computed as a decimal fraction.
M = Annual maintenance cost of 2,000,000-circ.mil cable in dollars per mile.
c = Value of losses in cents per kilowatt-hours.
C = Annual cost in dollars.

The annual charge per 1,000 kw. delivered is, then:

$$C = TIr + TM + \frac{\left(\frac{1{,}000{,}000}{V}\right)^2 \times 0.0285 \times 8760 \times c}{1000 \times 100 \times T}$$

$$= T\ (Ir + M) + \frac{25\,c \times 10^6}{V^2\ T}$$

Differentiating with respect to T and setting derivative equal to zero

$$(Ir + M) - \frac{25\,c \times 10^6}{V^2\ T^2} = 0$$

Whence

$$T = \sqrt{\frac{25\,c \times 10^6}{(Ir + M)\ V^2}} \text{ for minimum cost.}$$

Let

I = $13,600 per mile
M = $115 per mile

Taking r at 0.15 and c at 1 cent

$$T = \sqrt{\frac{25 \times 10^6}{2155\ V^2}} = \frac{1075}{V} \qquad (2)$$

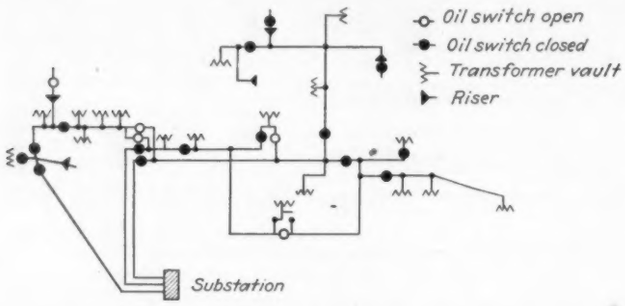
For V = 230 volts $\quad T$ = 4.7
For V = 240 volts $\quad T$ = 4.5

The annual cost curve for the values assumed is quite flat from T = 3.5 to T = 6.0, the increase of these limits being about 2½ per cent. Beyond these limits the curve rises very sharply for values of T less than 3.5 and less sharply for values of T greater than 6.

A Modern Subway System for a Small City

By C. D. Lippincott
Engineer Underground Department
New York Power & Light Company

THE New York Power & Light Corporation is just completing a revamp of the subway system in Schenectady, N. Y., including changing from 2,300 volts, three-wire, to 4,000 volts, four-wire, grounded neutral primaries. Some features are incorporated in the new layout of the underground system that, while not entirely new, are an answer to the problem of giving reliable service, duplicate feeds and easy and inexpensive means of sectionalizing



Any section of the primary circuit can be readily isolated

in an area of low load density without investment in an economically unjustified automatic network system.

On the old system, installed jointly with the street railway in 1903 and given very little attention until two years ago, all lighting transformers on a feeder (five feeders total) were banked solid on the secondary side and connected through obsolete cartridge fuse cutouts to the primary. The condition of all equipment was quite poor, and in many cases dangerous, especially since street railway feeders were in the same duct system and unprotected manhole entanglements with the New York Power & Light Corporation's cables.

The first step taken in revamping the system was to build and equip modern transformer vaults, in general approximately 20 ft. x 10 in. x 8 ft., under the sidewalks to replace the 6-ft. x 8-ft. x 6-ft. holes in the streets. Transformers are connected to the primary through heavy duty G & W cutouts, and in important installations to the secondaries through G & W type M distribution boxes. Each vault is designed to take three 100-kva. lighting transformers and a bank of power transformers.

In revamping the secondary system it was decided to continue the 230-volt, single-phase lighting secondaries and the 230-volt, three-phase power secondaries, inasmuch as the power load in the underground district is relatively small and concentrated in a few locations. Much of the No. 3/0 lighting secondary cable was dangerously overloaded and was replaced with 350,000-circ.mil and 500,000-circ.mil single-conductor cable.

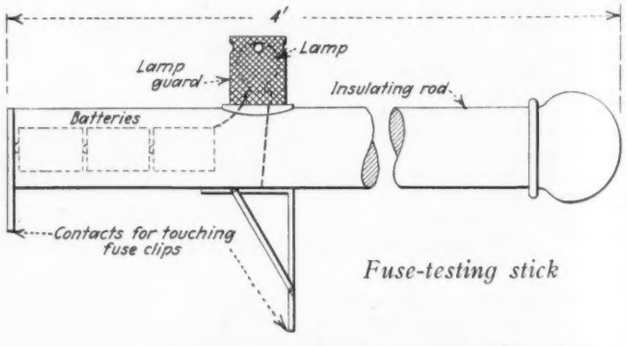
Since an automatic secondary network system would be economically unwarranted in a system of such low load density, it was decided to isolate all secondaries feeding from each transformer vault, banking together only the lighting transformers in a given vault. Two-pole type M-8 Condit oil switches were installed (normally open) in the lighting secondaries midway between transformer vaults and two-pole G & W type M solid link sectionalizing boxes installed at sectionalizing points on each lighting secondary. These oil switches, together with the primary and transformer secondary disconnects, make it possible to isolate a vault or section of primary and not interrupt lighting service, except momentarily in case the two adjacent vaults are on different phases. All oil switches, both primary and secondary, are marked "In Phase" or "Out of Phase." An oil switch tie between mains was found desirable on account of the heavy flashes experienced in energizing the large transformers from the secondary side. Similar ties are being constructed between all power banks, three-pole type M-8 Condit oil switches being used.

New 4-kv. buses and substation equipment for three 2,000-kva. feeders were installed in the substation feeding the district and three 350,000-circ.mil 4-kv. feeders extended to load centers with No. 4/0 branches to take in the various transformer vaults and also the overhead load of two of the old 2,300-volt feeders. These feeders were installed in duct lines occupied solely by the New York Power & Light Corporation, or, where occupied jointly with the street railway, steps have been taken to transfer railway cables to other duct lines. These feeders are of single-conductor cable on the load side of the first feeder switch and multiple-conductor cable from the station to the first feeder switch. They are sectionalized on the underground by means of three-pole type M-8, 4,500-volt Condit oil switches.

It can be seen from the diagram that any section of primary or any oil switch can be easily isolated for inspection, repairs or for repairing faults, customers suffering only momentary interruptions during switching operations. Both primary and secondary switching have been repeatedly accomplished satisfactorily, and in view of the relatively small investment in switching equipment as compared to that necessitated by an automatic network it is felt that a solution to the problem of reliable, safe supply for an underground area of low load density has been found.

A Handy Fuse-Testing Stick

FOR checking telephone and other fuses of the blade or ferrule type mounted above easy reach, the substation department of a Middle Western utility has devised the stick illustrated. The stick, which is 4 ft. long,



Fuse-testing stick

is bored out at the end to contain a flashlight battery, which is connected through a lamp to the two contact arms. Although this stick has only two contact points and may be used only on fuses of one length, it would be easy to add other arms with different spacings distributed around the stick or to make one arm movable along the stick. The construction is apparent from the sketch.

Economics of Corona Loss

Known facts regarding corona as developed by Ryan and Peek reviewed. Need shown for carrying investigation into field of economic voltage range of power transmission

By J. T. LUSIGNAN, JR.
Leland Stanford, Jr., University

IN LAYING out a transmission line for carrying a given normal load at a certain predetermined voltage there is an approximate value below which the line losses must be kept if the line is to operate as an economic link between the generating and distributing parts of the system. The conductivity factors affecting the ohmic portion of the line losses are quite well known, so that it is comparatively easy to control that part of the total loss and apportion accordingly. With the corona, or "leakage," loss into the air the problem is much more complex and difficult of solution due to the uncertain and incomplete knowledge so far gained of the factors involved, as far as the economic range of operation is concerned. (By the economic range is meant that range near the normal operating voltage and in which the corona loss is expected to be kept below a certain maximum figure.)

This lower economic range has been referred to by Peek as that of "local corona" and the upper region as that of "decided or full corona." It is in the latter region that his well-known law of corona holds and wherein the loss follows a quadratic relation with respect to the voltage. Ryan calls this the region of "fixed brush pattern" and wholly concurs with the relations which Peek has developed in his loss equation with respect to frequency, voltage, conductor diameter, spacing, surface condition and air density. Ryan has always found this law to check with actual measurements within the range of "full corona" on the conductors. A reproduction of a curve calculated from Peek's corona loss formula for a given conductor cable is shown[1] in Fig. 1.

The corona starting voltage and therefore the subsequent starting of the condition termed "local corona" are largely dependent upon atmospheric conditions and the condition of the conductor surface, two extremely variable factors. No successful means as yet have been devised for tying in these factors to give relations whereby this small but important loss can be predetermined with reasonable accuracy. It does not follow the quadratic law, but varies from it in an erratic manner. Figs. 2 and 3 are two curves[2] given by Peek to show this deviation from the quadratic law for two different sized conductors.

Ryan has termed the range of local corona as that of unstable brush pattern and is of the belief that due to the low order of energy involved several additional factors will be found to come in to have definite effects upon

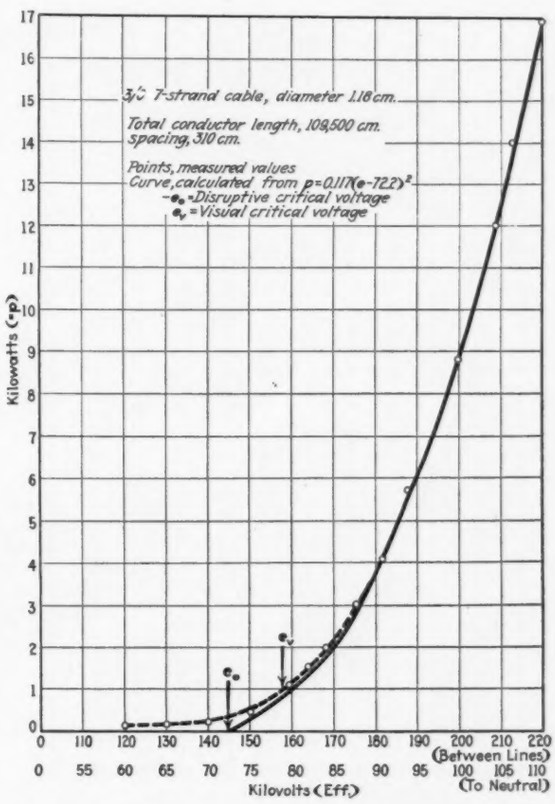


Fig. 1—Corona loss for a given conductor ca'culated from Peek's formula

The points on the plot are those taken from actual measurements on the same conductor and are seen to check very well with the calculated curve values for all but those at the lower end of the curve, which lie within the local corona range.

the loss, which factors were heretofore considered negligible and even absent entirely. He believes, as was found by Peek years ago, that humidity has little if any effect upon the loss over the full corona range, but that it will enter as a factor during local corona. A plot of several curves obtained from tests at Stanford University which show the effect of humidity on losses over the local corona range is shown[3] in Fig. 4. Mershon, from his corona tests at Niagara, reported a humidity effect present (*Trans.* A.I.E.E., Vol. XXVII, page 845) and developed a vapor pressure relation for securing a means of tying in a humidity factor with corona loss. Tests at Stanford have not substantiated Merchon's humidity relation, but neither have they led toward establishing a relation that would hold.

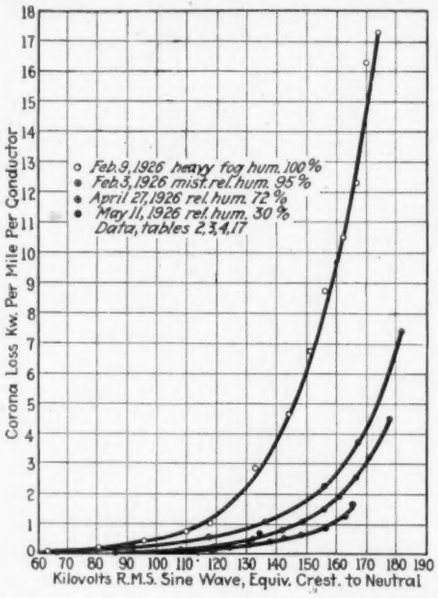
The conductor itself introduces further erratic fac-

[1] *Fig. 115, page 123, "Dielectric Phenomena in High-Voltage Engineering," by F. W. Peek, Jr.*

[2] *Figs. 131 and 132, page 144, "Dielectric Phenomena in High-Voltage Engineering," by F. W. Peek, Jr.*

tors due to its shape and the physical-chemical condition of its surface. When the surface is new, conditions are particularly unstable, but aging or weathering of the surface serves to stabilize the loss and gradually to diminish it. This effect is illustrated by the curves[3] of Fig. 5, made from tests on a concentric strand cable, these tests extending over a year and being all under approximately the same atmospheric and test conditions. The change of the conductor surface due to weathering or accumulated foreign deposits will vary somewhat over different localities for the same conductor material, so that it will undoubtedly be a difficult task to secure from experimental test results a general relation involving this factor that will serve for all conditions. Interpolation and extrapolation will probably have to be restored to in many cases from the results of tests made under conditions bearing the nearest similarity to those under which the projected line is to operate.

In his intensive study of corona loss on the Pit River 220-kv. lines of the Pacific Gas & Electric Company R. Wilkins (*Trans.* A.I.E.E., Vol. XLIII, page 1148) found a queer


Corona Loss Kw. Per Mile Per Conductor
Feb. 9, 1926 heavy fog hum. 100%
Feb. 3, 1926 mist. rel. hum. 95%
April 27, 1926 rel. hum. 72%
May 11, 1926 rel. hum. 30%
Data, tables 2, 3, 4, 17
Kilovolts R.M.S. Sine Wave, Equiv. Crest. to Neutral

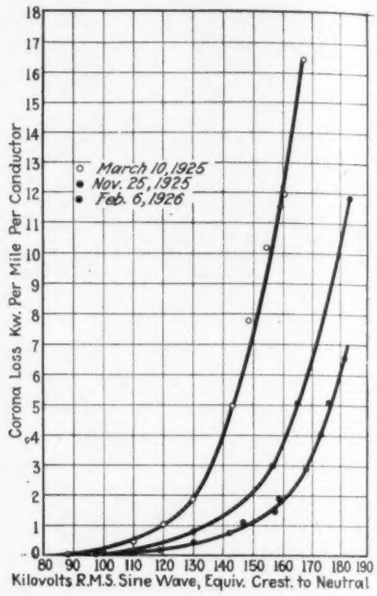
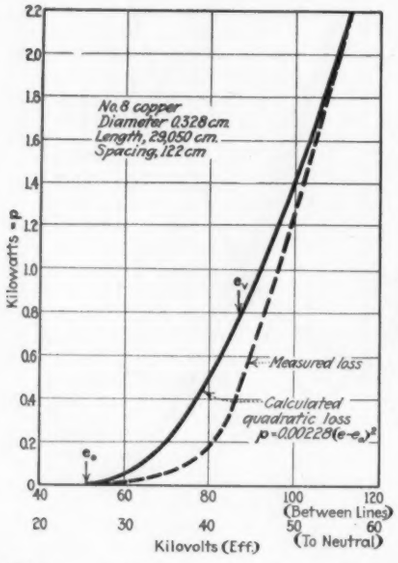
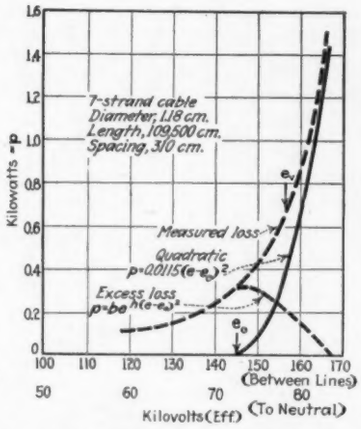


Fig. 4 (at left)—Effect of humidity on corona loss on concentric strand cable. Fig. 5 (at right)—Effect of weathering of concentric strand conductors on corona loss





Figs. 2 and 3—Curves calculated for two different size conductors to show deviation from quadratic law

The measured curve for the large conductor lies above the calculated curve, while that of the small conductor lies below the calculated curve. Peek has suggested the entrance of a probability law relation within this lower range.

change in the loss relation within the local corona range on the aluminum conductor which did not manifest itself correspondingly on the copper conductor. This suggests the entrance of a possible chemical effect into the corona-forming mechanism, which would vary with different conductor materials. The belief generally shared by most authorities has been contrary to this, as it felt that the material of the conductor had no effect. Mr. Wilkins' findings, though, bear out the need for a more careful study of this possible factor so that its true relation to corona loss may be definitely established.

[3] *Stanford University Thesis (1926), Drodjin and Wiedeman.*

The corona loss on a conductor begins at the critical corona-starting voltage and increases with the voltage rise above this value much more than proportional tc the first power of this voltage difference. Therefore the loss with the higher line voltages soon becomes excessive after the critical voltage is reached, and with several large systems now operating at 220,000 volts and others planned for this and even higher voltages there is an urgent need already for a more thorough study of the field over the local corona or economic range. In the report of his recent corona loss tests referred to here, Wilkins says, "At present there seems to be no way of determining what the corona loss on a proposed line will be at the voltage at which it is to operate, and this is the particular region in which power company engineers are interested." In regard to the corona loss suffered on the 220-kv. Pit River lines of his company, he adds, "These represent losses in the order of $100,000 per year, and bear out the statement that it is desirable to know the loss under operating conditions." The fact that during storms the critical voltage must be expected to be lowered considerably (Peek estimating an average reduction of 20 per cent) emphasizes a further need for such a study.

The problem of reducing corona losses on the higher voltage lines has been actively entered into by the manufacturers of transmission conductors, and they have bent their efforts toward securing efficient conductor designs which embody larger diameters with equivalent conductivity properties. The steel-core concentric-strand aluminum conductor has been one outgrowth of such work, while the concentric-strand copper conductor with twisted I-beam center has been another, although of more recent development. J. P. Jollyman, Pacific Gas & Electric Company, has indicated a criterion for the proper selection of conductor diameter in his remark that "under present-day costs, an increase in conductor size may be justified when the corona loss exceeds one-

quarter of the I^2R loss" (*Trans.* A.I.E.E., Vol. XLIII, page 1168).

Several authorities, including Ryan and Peek, have expressed the opinion that in the design of a transmission line the size of conductor to be selected should be such as to assure a negligible fair weather corona loss. This should then permit of economic operation over the entire year, at the same time allowing for intermittent and localized abnormal corona losses during storms. In the case of some lines already designed and in service

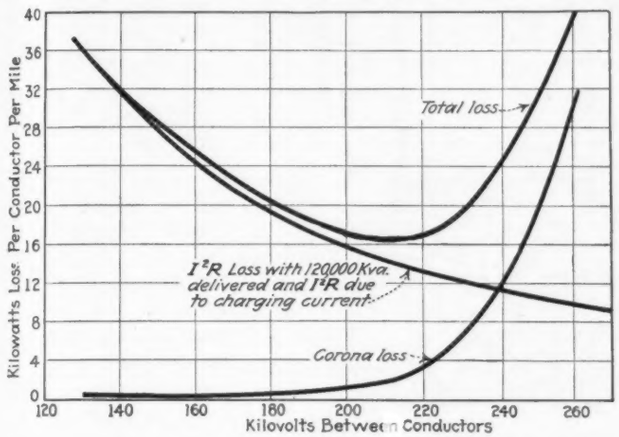


Fig. 6—Conditions under which it is economical to operate a line developing corona for a given load and line voltage

The curves represent average fair weather conditions on the Pit River 220-kv. line of the Pacific Gas & Electric Company, using measured resistance and test values for corona loss. The 120,000-kva. load was arbitrarily chosen. Other load values shift the low point in the curve—that is, the point of most economical loading, back and forth.

transmitting a given normal load it is often found decidedly uneconomical to operate below a certain corona loss value. An example of such a situation is illustrated by Fig. 6, which is a plot of a series of curves very kindly loaned by Mr. Wilkins. The curves show the losses of both I^2R and corona origin for one of the 220-kv. lines of his company, at various line voltages and a given kilovolt-ampere load transmitted. It can be seen readily that the curve of total line loss has a definite minimum range for but a small variation around the normal line voltage. In that way any appreciable decrease in line voltage made in an attempt to lessen the corona loss would in turn cause a more than corresponding rise in I^2R loss, which would greatly offset any gain sought for.

In many of the corona loss investigations of the past, which were intended to assist in the study of the problem and particularly to ascertain the factors affecting corona, various fallacies existed in the testing methods and conditions involved. Accordingly the results obtained and the consequent theories derived from them were hardly reliable and consistent, especially for the local corona range when the losses were small. Often the tests were carried out on long lines where erratic and sometimes no corrections at all were made for the differences in voltage along the lines, variations in atmospheric and topographical conditions over different sections of the lines, and insulator losses. In cases where the conductor specimens were comparatively short and actual line losses small, the losses of the connected transformers were therefore appreciable and were often inaccurately corrected for.

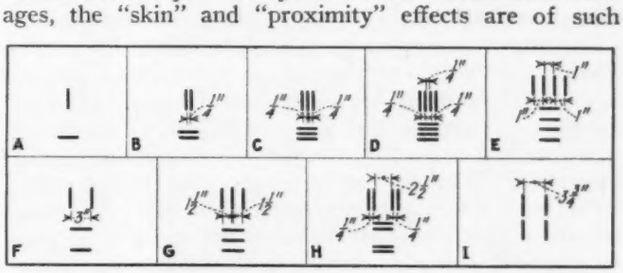
It is planned at the new Harris J. Ryan laboratory at Stanford to begin a thorough study of the losses within the economic range under as many atmospheric and line conditions as it is possible to simulate. In this way it is hoped to make a start toward securing a thorough understanding of all the possible factors that could have any bearing on corona and therefore affect its starting voltage and the magnitude of the subsequent loss evolved near that point. As previously noted, Peek's quadratic law is probably the only reliable one applicable to corona calculations at present, but its use is limited to the upper or full corona range, as it was derived from test measurements over that region.

In taking the measurements at Stanford, use is to be made of the high-voltage wattmeter, the development of which has been progressing over the last four years. In this way measurements will be made directly on the lines so that the transformer losses and any errors that would ordinarily arise from them will be eliminated. All conductor specimens will be hollow and will have separate leads run inside of them, through which the losses to the insulators will be supplied, the power for this being bypassed around the wattmeter so that the latter will not indicate it. The conductors will be mounted on towers on the 1½-mile right-of-way leading out from the laboratory, and will be of such length and height as to insure constant conditions of test for the particular set of loss readings being obtained. In order that the investigation will be as complete as possible, it will be necessary to extend the tests over a period of several years to secure the requisite number of different atmospheric conditions for formulating rational relations for the factors of air density, humidity and surface conditions as affected by aging.

In addition to the need for a more thorough understanding of the factors affecting corona from the standpoint of actual line losses incurred by the power company, there is another consideration arising from the standpoint of inductive interference. It is well known that with the manifestation of corona on a line, harmonics begin to appear and to increase in magnitude and number as the voltage is raised above the critical value. These harmonics are often of such frequency and magnitude as to cause appreciable interference with near-by telephone and telegraph lines. With radio now assuming an important status in the communication field, interference with reception may be encountered along a transmission line developing corona. Corona may also add difficulties to successful communication by carrier current that the power company itself may be striving for over its own transmission line.

Current Capacities of Copper Buses

WITH buses composed of multiple ¼-in. copper bars spaced ¼ in. apart and mounted on edge, carrying above 3,000 amp. at 60 cycles at usual distribution voltages, the "skin" and "proximity" effects are of such



Bus arrangements tested for current capacity

CURRENT-CARRYING CAPACITY OF COPPER BUSBARS

30 Deg. C. Rise—25 Deg. C. Ambient

Fig.	No. Bars	Spacing	Area Sq.In.	Amp. Capacity Horizontal	Amp. Capacity Vertical	Amps. per Sq.In. Horizontal	Amps. per Sq.In. Vertical
			¼-In. x 4-In. Bars				
B	2	¼ in.	2	.....	2,700	.....	675
			½-In. x 4-In. Bars				
A	1	....	1	1,200	1,250	1,200	1,250
B	2	¼ in.	2	1,730	1,900	865	950
F	2	⅜ in.	2	2,160	2,710	1,080	1,350
C	3	¼ in.	3	2,030	2,530	680	840
G	3	1¼ in.	3	2,420	2,970	810	990
D	4	¼ in.	4	2,320	2,740	580	690
H	4	¼ in., 2¼ in., ¼ in.	4	2,580	3,500	650	880
E	4	1 in.	4	2,700	3,250	680	810
I	4	Hollow square	4	.....	4,600	.....	1,150
			½-In. x 3-In. Bars				
A	1	....	0.75	1,000	1,150	1,340	1,540
B	2	¼ in.	1.5	1,650	1,820	1,100	1,220
F	2	⅜ in.	1.5	1,830	2,100	1,220	1,400
C	3	¼ in.	2.25	1,850	2,450	820	1,090
G	3	1¼ in.	2.25	2,150	2,470	960	1,100
			½-In. x 2-In. Bars				
A	1	....	0.5	650	900	1,300	1,800
B	2	¼ in.	1.0	1,200	1,550	1,200	1,550
F	2	⅜ in.	1.0	1,350	1,650	1,350	1,650
C	3	¼ in.	1.5	1,650	1,820	1,100	1,210
G	3	1¼ in.	1.5	1,900	2,100	1,260	1,400

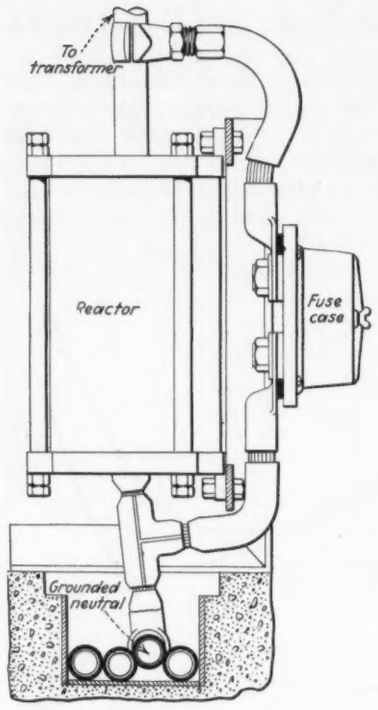
magnitude as to require a very inefficient and uneconomical use of copper. Also, at voltages of 480 and below and with currents of 5,000 amp. and more the reactance of the bus is appreciable and must be considered.

From tests made by the Commonwealth Power Corporation of Michigan a report on the design of heavy-duty buses was prepared and presented to the electrical apparatus committee of the Great Lakes Engineering Section, N.E.L.A., at a recent meeting. The test results are summarized in the tabulation and its accompanying figures here reproduced from the report. The values of maximum current capacities given are for a 30 deg. C. temperature rise with an ambient temperature of 25 deg. C. The tests were conducted in a free circulation of air, using a single-phase, 60-cycle source of energy. In a three-phase bus the resultant effect of the currents in any two conductors on the other conductor is similar to the effect of the current in the return circuit of a single-phase bus with slightly greater spacing. Subsequent tests have shown that the values given are applicable to three-phase bus design. The figure designations in the tabulation refer to the arrangements in the sketch.

Network Transformer Protection

IN THE distribution network of the Dallas (Tex.) Power & Light Company it was desired that the good regulation characteristics of low secondary reactance transformers be had without the consequent increased liability to transformer failure or burnt-out under ground, short-circuit or other overload conditions.

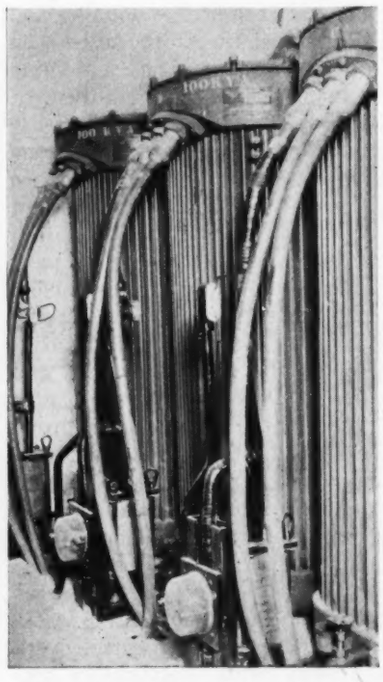
The transformers on the Dallas network are of the ordinary low reactance distribution type inclosed in subway cases. In series with each transformer secondary and the grounded neutral is a parallel circuit consisting of a fuse and a reactor, as shown in the accompanying illustration. The reactor is simply a laminated cylinder through which a single conductor is run. The laminations are not closed circles; they are so cut as to give the magnetic path a $\frac{1}{16}$-in. air gap, thus flattening out the flux curve to approach a straight line. The fuse is of



Fused reactors for transformer secondary protection

the link type inclosed in a meter cover glass case. In the usual case of a 100-kw. transformer the fuse is rated at 800 amp. In comparison with the fuse the reactor impedance is extremely high, so that practically all of the current during normal operation flows through the fuse.

Under ordinary operating conditions the reactance of the secondary circuit is low and it may be loaded up to the limit of the fuse without great effect on voltage regulation. If the secondary current for any reason reaches such a value as to blow the fuse the reactor is thus automatically cut into the circuit to protect the transformer. The value of this device was demonstrated in Dallas shortly after the network was put into operation when a new hotel was opened. The transformers were perfectly adequate to carry the normal load. But on its opening night the new hotel was ablaze with light, every lamp turned on. The fuses paralleling the reactors did not blow at once; for a time the other transformers in the network took shares of the hotel load. But as the total network load increase the transformers nearest the hotel reached and passed the capacity of their fuses. The fuses did not blow; they softly melted away and the overload was thrown back on the network, permitting the hotel to shine with no noticeable decrease in brilliancy. The time required for the fuses to melt was not long enough to permit the transformers to reach a dangerous temperature. Thus a load that very probably will never reach the same proportions again was prevented from ruining a set of transformers.



Reactors and fuses installed in transformer vault

Water-Power Resources of British Columbia

THE water-power resources of the Province of British Columbia are estimated at 1,930,000 hp. minimum and 5,100,000 hp. for six months, of which 460,562 hp. has already been developed. The full opportunities are, however, not reflected in these figures, as, in most cases, they are based upon the actual unregulated flow of streams and rivers and take no account of numerous natural opportunities of storage, concentration of flow of several streams, etc., which would undoubtedly make possible the development of power very considerably in excess of the sum of the powers available on the individual streams.

The wide variations of topography and climate, consequent upon the existence of three mountain ranges in the province, produce power opportunities ranging from the low and medium to heads exceeding 2,000 ft.

The principal central-station systems in the province are those supplying the Vancouver, Victoria and Nelson districts. Vancouver draws its power supply from three water-power developments. Two take water from Coquitlam Lake and have an aggregate installation of 84,000 hp. The third is located on Stave River and develops 75,000 hp. A further development on Alouette Lake of 10,000 hp., under automatic control from the Stave River plant, will be in operation shortly. There is also another development already under way on the Bridge River. The ultimate capacity of this installation will be close to 500,000 hp. under a head of 1,200 ft. All of these plants are controlled by the British Columbia Electric Railway or its subsidiaries.

For the Victoria district, the major power supply is from Jordan River, where 25,000 hp. is developed under a head of 1,145 ft.

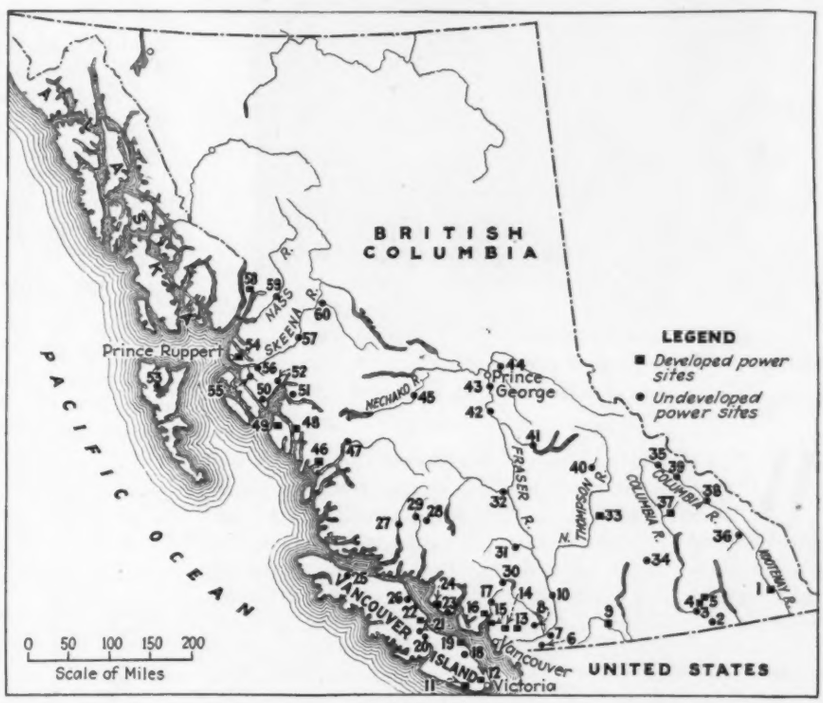
In the Nelson district the principal power stream is the Kootenay River, on which the city of Nelson has a small plant, and the West Kootenay Power & Light Company has two plants, one of 34,000 hp. capacity and one of 60,000 hp. capacity, while another plant of 60,000 hp. is now under construction and others are contemplated.

While the above are the principal central-station systems in British Columbia, mention should be made of the East Kootenay Power Company's developments on the Bull and Elk Rivers, aggregating 22,000 hp., which supply Fernie, Cranbrook and other places in the Crow's Nest region, and of the municipal developments of Kamloops and Revelstoke.

The principal mining developments in British Columbia from the water-power standpoint are three in number: The Britannia Mining & Smelting Company, Ltd., has 15,430 hp. installed on Britannia Creek under a head of 1,810 ft.; the Granby Consolidated Mining, Smelting & Power Company has an installation at Anyox on Falls Creek, where, under an average head of 375 ft., 13,400 hp. is installed; the third large development is that of the Canadian Collieries (Dunsmuir) Ltd., on Vancouver Island, which has a 275-ft. head, 12,000-hp. installation on the Puntledge River.

Mention should be made that the major portion of the output of the West Kootenay Power & Light Company's plants on the Kootenay River is utilized for electrolytic refining of copper, lead and zinc in the Consolidated Mining & Smelting Company's works at Trail.

The principal pulp and paper plants in the province are the Powell River Company, which has a 48,000 hp. development on Powell River, and the Pacific Mills, which has a 26,850-hp. installation on the Link River at Ocean Falls.



Some important water powers of British Columbia

	Undeveloped	Minimum Horsepower	Maximum Horsepower
2	Pend d'Oreille River	141,150	605,030
3	Kootenay River	101,130	168,750
6	Chilliwack River	45,160	70,000
7	Jones Lake	8,340	15,710
8	Chehalis River	5,750	18,650
10	Fraser River	218,000	545,000
17	Cheakamus River	25,000	63,480
18	Nanaimo River	16,730	36,400
20	Stamp River	4,380	17,600
21	Ash River	4,800	9,610
23	Lois River	10,750	35,860
25	Nimpkish River	2,780	25,000
26	Campbell River	26,800	57,330
27	Klinaklini River	7,500	20,000
28	Homathko River	20,450	54,550
29	Mosley Creek	20,450	54,550
30	Green River	2,750	14,340
31	Bridge River	57,270	350,000
32	Chilcotin River	11,710	31,230
34	Shuswap River	7,630	15,620
35	Columbia River	28,730	105,500
36	Toby Creek	6,160	18,560
38	Kickinghorse River	12,650	43,350
39	Columbia River	46,200	151,600
40	Murtle River	16,490	41,180
41	Quesnel Riv., S. Fork	16,340	45,580
42	Fraser River	17,000	51,000
43	Fraser River	26,500	79,650
44	Willow River	4,760	13,480
45	Upper Nechako Riv.	13,700	41,110
47	Dean River	5,290	11,910
50	Kumowdah River	6,720	7,000
51	Crab River	10,000	10,400
52	Foch Creek	7,500	11,200
53	Ain River	4,360	13,980
55	Falls River	3,030	12,160
56	Khtada River	2,540	9,790
57	Skeena River	23,980	69,670
59	Nass River	141,150	605,030
60	Bulkley River	37,250	111,770
	Other power sites	338,430	1,437,370
		1,930,000	5,100,000

	Developed	Horsepower	Static Head, Feet
1	Bull River	7,200	275
4	Kootenay River	60,000	65
5	Kootenay River	36,200	66
9	Similkameen River	1,600	67
11	Jordan River	25,000	1,145
12	Goldstream River	3,000	650
13	Stave River	75,000	125
14	Buntzen River	84,000	395
15	Britannia Creek and others	15,430	1,810
16	Cedar Creek	1,150	1,080
19	Millstone River	1,350	129
22	Puntledge River	12,000	275
24	Powell River	48,000	157
33	Barriere River	2,200	190
37	Illecillewaet River	2,300	73
46	Link River	26,850	145
48	Swanson Creek	2,180	156
49	Cougar Lake	1,200	70
54	Woodworth Lake	1,650	270
58	Anyox Creek	12,000	375
	Other plants	42,252	....
	Total developed	460,462	

Three-Winding T
Tap Changing U

By K. A. OPLINGER

Transformer Engineering Department
Westinghouse Electric & Manufacturing Company

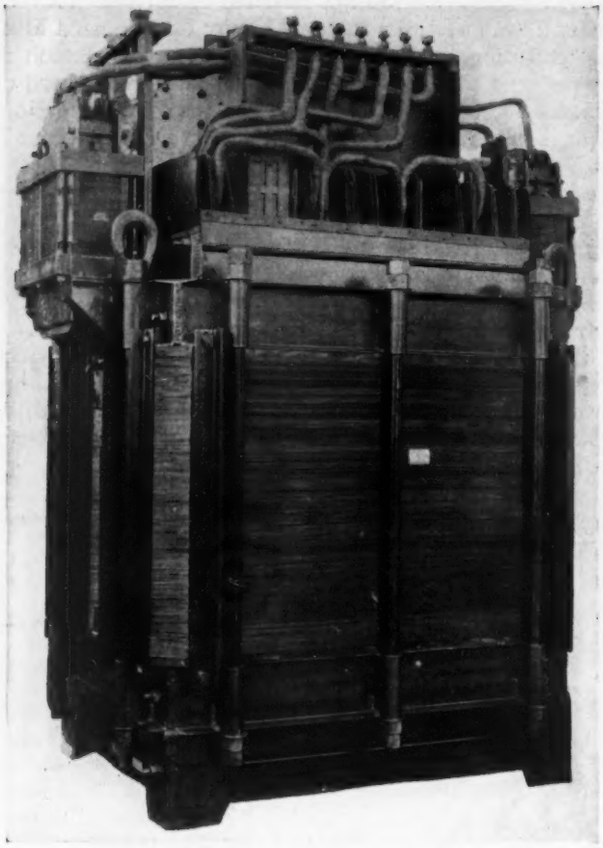


Fig. 1—Transformer core and coils with preventive auto-transformers on each end

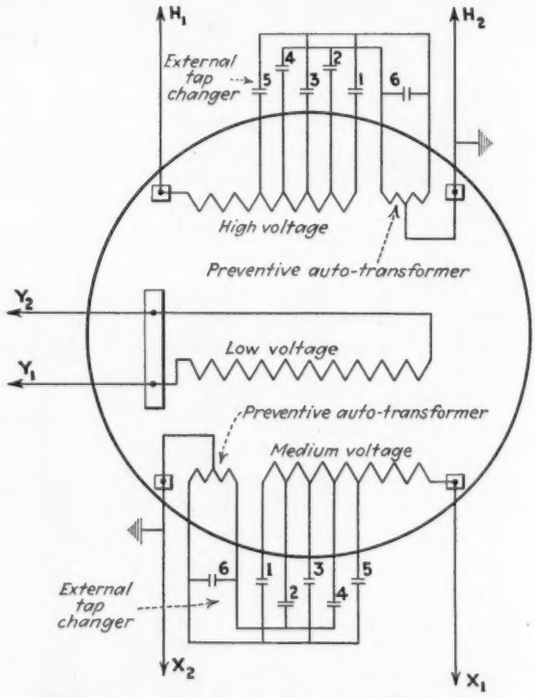
WITH the extensive interconnection of power systems the three-winding transformer has established itself as a very important piece of apparatus, and particularly in applications where three distinct systems must be tied together to meet operating requirements.[1] The variations of voltage ratio on three-winding transformers where large blocks of power are involved is very important from the operator's standpoint. If a maximum power economy and flexibility are to be obtained it should be possible to control the power flow in any direction between the windings of a three-winding transformer.

The advantages of controlling the voltage ratio of two-winding transformers under load have been demonstrated by numerous applications during the past few years. These same advantages apply to the three-winding transformers, and are perhaps of even greater importance where three systems, operating at different voltages, are tied together through the medium of a single transformer bank.

In considering the application of equipment for changing taps under load to three-winding transformers it is essential that simple equipment be used. Any scheme of changing taps under load which requires additional windings on the main transformer or an intricate switching cycle is objectionable from the standpoint of design because of the complications introduced.

The single-winding method of changing taps under load[2] is particularly adaptable to the three-winding transformer because of its simplicity. Fig. 2 shows the first application of this scheme to the high and medium voltage windings of a 20,000-kva., single-phase transformer. When operated in a three-phase bank this transformer is delta connected on the 12,000-volt winding and star connected on the 132,000- and 66,000-volt windings of the high-voltage side.

With the use of the above scheme no additional windings are required on the main transformer. Taps are changed directly on the main transformer windings by switching two preventive auto-transformers across taps. Each preventive auto-transformer is connected in the



	SEQUENCE OF TAP CHANGING								
Positions	1	2	3	4	5	6	7	8	9
% Voltage	100	97½	95	92½	90	87½	85	82½	80
Switch No. 1	○	○	○						
No. 2			○	○	○	○			
No. 3				○	○	○	○	○	
No. 4						○	○	○	○
No. 5								○	○
No. 6	○		○		○		○		○

○ = Switch closed

Fig. 2—Single-winding method of changing taps under load

[1] *"Transformers for Interconnecting High-Voltage Systems or Feeding Synchronous Condensers From a Tertiary Winding," J. F. Peters and M. E. Skinner, A.I.E.E. Transactions, January, 1921; "Three-Winding Transformers," J. F. Peters, "Electric Journal," January-February, 1925.*

Transformers with Under Load

Energy flow between windings controlled

Description of types of transformers and methods for changing taps under load

Design principles and details

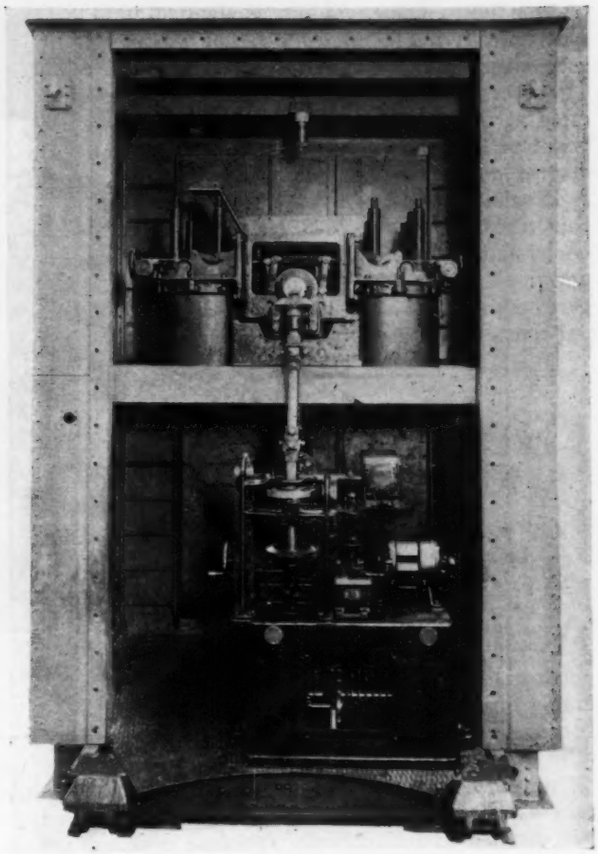


Fig. 3—External operating mechanism and switches for tap-changing transformer

neutral end of the transformer winding with which it is used, and the mid-points of the preventive auto-transformers are brought outside the transformer case, where they are solidly and permanently grounded.

The number of taps required is reduced to a minimum by the use of the mid-tap on the preventive auto-transformer, which gives an additional voltage step between each set of adjacent taps on the main transformer winding. The sequence chart in Fig. 2 shows how this mid-tap is used and also the switching cycle for a complete change of taps. All switches and moving mechanical parts used in connection with the tap-changing equipment are located outside the main transformer tank. This arrangement is possible because of the simple tap-changing mechanism and switching cycle that is used.

The transformer core and coils with the small preventive auto-transformers, which are used with the high- and medium-voltage windings, mounted on each end and supported directly on the top end frame, are shown in Fig. 1. It will be noted that the shell form of construction has been used on the main transformer. This form of construction has proved to be especially desirable for three-winding transformers because of the ease in obtaining the desired reactance between windings.

The external equipment, consisting of an operating mechanism and switches, is shown in Fig. 3. The operating mechanism is designed for motor operation by remote control with provision for emergency manual operation.[3]

Fig. 4—Late model of tap-changing transformer with protected mechanism

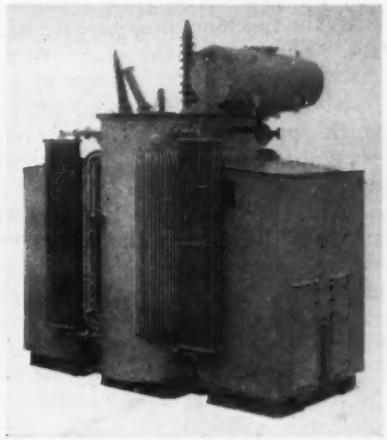


Fig. 5—Tap changers are installed on two windings of this transformer

Each tap-changing mechanism forms a complete unit with individual control equipment and remote position indicator. However, when used in a three-phase bank the control is initiated by a single control switch and taps are changed simultaneously in all three phases.

A later model of the same type of tap-changing equipment is illustrated in Fig. 4. In this latter design the mechanism has been simplified and the switches are mounted directly on the tap-changing mechanism. The tap leads from the main transformer winding are brought out near the top of the transformer tank and connect to the switches below. The entire equipment is covered by a boiler-iron house.

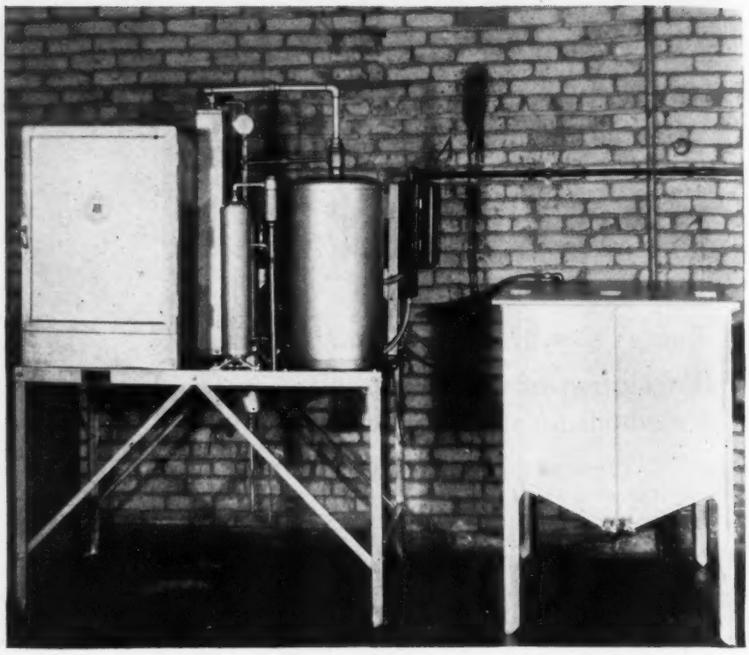
In the case of the three-winding transformer described above, the tap-changing mechanism for use in the high-

[2]*For details of this scheme refer to "Changing Transformer Voltage," K. A. Oplinger, "Power," July 26, 1927; "Transformer Voltage Control Under Load," L. H. Hill, "Power Plant Engineering," June 1, 1927.*

[3]*Details of this apparatus will be found in "Equipment for Controlling the Voltage Ratio of Transformers Under Load," K. A. Oplinger, "Electric Journal," April, 1927.*

and medium-voltage windings is identical and mechanically interchangeable so that the same mechanism may be used in either winding. However, if both windings are to be regulated at the same time two mechanisms are required. Fig. 5 shows the complete transformer with two tap-changing mechanisms.

Provision has been made in the design of this transformer for future external water coolers and forced oil circulation. With this additional cooling the transformer bank will carry a total of 75,000 kva. without exceeding temperature guarantees.



Oil-reclaiming equipment cuts cost of truck operation

Saved 67 per Cent on Fleet Lubrication

By G. A. Doeller,
Assistant Manager Electrical Division, Dayton Power & Light Company

A LITTLE more than a year ago, while checking our transportation costs, we noted that we were throwing away a considerable quantity of crankcase drainage. Information received from the Bureau of Standards and other leading chemists soon convinced us that if this used oil were reclaimed properly it might be as good a lubricant as new oil, in some respects perhaps even better. We decided to reclaim our crankcase drainage provided we could find a machine which would meet the following specifications:

1. Reclaimed oil to be equivalent to new oil as a lubricant.
2. Reasonable operating cost per gallon.
3. The machine must be safe and simple to operate.
4. Moderate initial cost.
5. The machine guaranteed by a reliable manufacturer.

After some investigation, we discovered a reclaimer which appeared to fulfill these requirements, and since its manufacturers were willing to offer a 30-day trial the unit was ordered on approval. We had previously started to save our crankcase drainage and had a number of barrels on hand when the machine was installed for test. Numerous samples were taken and analyzed. The tests showed the reclaimed oil characteristics to be practically the same as new oil specifications with the exception of color. While at first a little skeptical of the darker color, we are now convinced, after the results obtained during the past year, that color has little or no bearing on the lubricating value of an oil.

The reclaimer adopted purifies the oil by a continuous process, crankcase drainage being drawn into the unit by vacuum from the tank at the right, and after being refined and filtered the reconditioned oil is discharged at the left. The dilution distilled from the drainage is collected in the tank below the reclaimer. This dilution has been found to be an excellent penetrating oil. Distillation takes place under vacuum, which enables the liquid impurities to be taken off at a much lower temperature than would otherwise be possible. This not only reduces the electric energy required but also avoids overheating or cracking of the oil.

Since this equipment is entirely automatic, our labor charge against it is negligible. In fact, the total operating cost, including new filters, electric current and labor, has averaged only about 40 cents per hour. Since the machine delivers five gallons of refined oil per hour the reclaiming cost per gallon is 0.08 cent.

Better than 67 per cent saving in oil costs per car has been obtained since using the reclaimer, which has more than paid for itself in one year of operation.

Attractive Bulletin Board

NO SAVINGS, expressed in definite figures of dollars and cents, can be credited to this bulletin board, but in terms of fewer accidents, less lost time by workmen and uninjured employees it is proving its worth. This board is on the site of Delray power house No. 3, now being built by the Detroit Edison Company and which may be discerned in the background. News pictures are changed on the board daily, and these attract the men

Safety bulletins changed daily on construction job

to the accompanying safety messages. Delray has set an enviable record for safety in construction work. Employees have been urged to keep safety in mind at all times.

$24 Merchandise per Customer

Nebraska central-station company has organized its sales division to develop the domestic load in an agricultural district

By S. Ray Edington
General Commercial Manager Central Power Company, Grand Island, Neb.

THE Central Power Company operates in what is known as the Loup Valley, the Platte Valley and the Missouri Valley districts of Nebraska, which are all strictly agricultural. The company serves a population of some 61,000 people. The towns are all small. The largest, Grand Island, in which is located the general offices of the company, has a population of about 15,000. The industrial power load is comparatively small, the larger power users being flour mills and irrigation projects. The largest single installation in power will not exceed 620 hp. in connected load, so it can readily be seen that it is necessary for the company to merchandise all types of electric appliances in order to maintain at least a normal increase in gross revenue. As much consideration is given to the small household appliances as to the larger devices.

This has the effect of bringing salesmen in direct contact with practically all classes of service, thereby creating better public relations and instilling in the minds of customers the thought that we are endeavoring to carry merchandise of a good quality, yet diversified enough to meet the desires of all.

Selling Organization

The Central Power Company employs seven salesmen and three district commercial managers. All men work on a commission basis. This method of merchandising has proved most successful for us. There has been considerable argument as to the best method of compensating salesmen in merchandise work, but we have found that the commission basis carries the best incentive. Our men have all been with the company for a long time and the co-operative spirit that exists eliminates dissension among salesmen. Each man is satisfied with his position and is striving to build up for himself a customer clientele which means better business for him and a promotion in the end.

In the accompanying diagram it will be seen that the salesmen report to the district commercial manager for all instructions. They also mail in a daily report to the general commercial manager, a copy of which is filed with the district commercial manager, who, in turn, reports to the district manager and makes out a weekly report, sending one copy to the district manager and one to the general commercial manager. All matters pertaining to new business, advertising and merchandise sales are reported by the district manager to the general commercial manager, who has charge of all new business, advertising and merchandise sales and reports direct to the general manager.

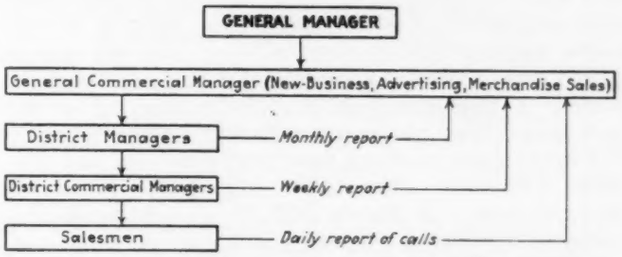
Year's Program Planned

Our merchandise department is operated along the following lines: At the end of each year the entire commercial department holds a conference and formulates the commercial program for the coming year. In this program we outline the various campaigns we will conduct month by month, confining this to two major appliances each month, one a campaign special, which, of course, is the large appliance which will be specialized by the men in the field, and the other a smaller, seasonable appliance which is called the store special and is sold by window and newspaper advertising.

At this conference we make up a standard merchandise stock list for the coming year. This gives the purchasing department an opportunity to take care of a minimum and maximum amount of stock for each of the district stores. Each district store is given a copy of the commercial program and also the standard stock list, and from these they are able to keep up their stock in order to be ready for the next month's activity.

Keeping Salesmen Up to Date

A district salesmen's school is held twice a month, meeting on alternate Monday nights. During the year 1927 we took up the N.E.L.A. salesmen's course, and at present we are devoting our lessons to electric refrigeration. We also have a general sales meeting of all the salesmen and commercial managers, which is held once a month. At the meetings we go over the coming month's program and merchandise to be sold, discussing the advertising, planning our window decorations and the arrangement of the stores for the sales. The purchasing



Executive organization of the commercial division of the Central Power Company

department is then notified of the amount of merchandise needed for the coming campaign.

In order to make our commercial program function properly the advertising is made up and delivered to the district offices not later than the twenty-eighth of the month prior to its being used for the monthly campaign. This gives each district office and the salesmen a chance to look over the copies of the advertising before they are delivered to the newspaper for publication, and in that way they know what is being advertised each day. The windows and offices are then decorated to tie in with the advertising. Having all this information in advance, the salesmen can analyze their territories and concentrate their efforts in the districts where they know they will receive the best results from this particular sale.

For the year 1927 gross merchandise business was $190,544, and we had at the end of 1927 a total of 8,057 lighting customers, making a merchandise income of $23.64 per customer. For the first five months of 1928 merchandise sales have increased 25 per cent over the same period last year. It is estimated that the merchandise sold during 1927 increased the gross revenue about $25,000.

Net profit from merchandise sales is relatively small as all costs of sales promotion are charged to merchandise sales. The pioneering and promotion of electric refrigerators and electric ranges are included in these costs and not charged to new business. We will agree that

charging of such development work to merchandising expense does not present a true picture, but we have been able to show a small profit in our merchandise department and allow it to carry all the costs of promotion of merchandise sales.

City Buildings Grouped in Lighting Betterment Plan

EXTENSIVE improvements in the lighting of city buildings at Fitchburg, Mass., have been in progress during the past year as a result of a comprehensive survey of existing installations by the city authorities in co-operation with the Fitchburg Gas & Electric Light Company, one of the utilities operated by Charles H. Tenney & Company of Boston.

Fitchburg, like many other cities and towns, had been using its schools, fire stations and other public buildings without realizing the progress in illumination available to the community at moderate cost in view of the potential benefits. Until a survey of actual conditions was made little data had been brought before the city governmental authorities either to indicate the need of betterment or to point out a line of procedure by which this could be realized. The treatment of the problem as a whole by a general survey of all major city buildings was decided upon after conferences between Mayor Lowe and the Tenney representatives, and the results of the survey were so promising that piecemeal methods were at no time considered desirable in carrying out the recommendations placed before the city administration.

Twenty-three buildings have been gone over and provided with better illumination as a result of this co-operative work. In March, 1927, Stephen B. McDonald, inspector of wires at Fitchburg, submitted an exhaustive report to the Mayor setting forth the conditions found in the field, the improvements recommended and the savings within reach. A. G. Neal, manager, and W. J. Marlowe of the central-station company co-operated in this work, and the Hibbard Electric Company of Fitchburg was the successful bidder for the wiring contract. The survey embraced sixteen school buildings, five fire stations, the city hall and police station. It was estimated that these schools and fire stations could be furnished with improved lighting and electric power service (in place of 57 water motors long in use) for an outlay of about $17,000 net, compared with an expenditure of $20,000 on a piecemeal basis. The work of improved installation was begun in April and in the main was completed in September before the opening of the fall term of the schools. The relighting of the city hall and police station was left to be done after the school and fire station betterment had been finished.

The older school installations seldom exceeded 2-foot-candles intensity on the desks, and this has now been raised to 5, with fixtures installed for 7-foot-candles ultimately. In general, the schools are now provided with 14-in. and 16-in. Ivanhoe reflectors, some 800 Trojan units having been purchased on one order. Westinghouse "Solux" units have also been installed. Lamps of 200 and 300 watts rating are generally employed in classroom lighting, wiring being with rigid flexible metallic conduit. Each building has been provided with a modern meter and switchboard, and in general the standard service to a school is by a ½-in. service pipe and three No. 4 conductors. Holophane units have been used extensively in corridors. Westinghouse sleeve-bearing motors, ranging from ¼ to 7.5-hp. rating, have replaced the water motors, which had a combined rating of 80 hp. and which were consuming some 72,000,000 gal. per year in driving ventilating fans and other machinery.

In the fire stations intensities have been raised from 2 to 5 foot-candles, Trojan units being installed in the bedrooms, with modern bed lamps for local reading. Lamps of 100 and 200 watts rating are generally used. The lamps found in the old installations varied from 16 cp. carbon incandescents to 500-watt bare units, and there were many wiring details which demanded modernization, notably in the elimination of drop cords and safeguarding of switches. About $2,000 worth of material was salvaged and $1,200 worth of lamps purchased in connection with the betterment work.

Great Lakes N.E.L.A. Sponsors Lamp Sales

EMPTY sockets and failure on the part of customers to keep a stock of spare lamps on hand not only causes a considerable aggregate loss in revenue to the lighting company but customers themselves experience inconvenience and inadequate lighting which, incidentally, may be charged against poor service. To correct this condition the merchandising committee of the Commercial Section, Great Lakes Division, N.E.L.A., is sponsoring an interstate lamp activity in the form of a contest between companies in the division. The campaign will be based on the retail sales by employees made during any 30-day period between Sept. 1 and Dec. 1, 1928.

Every member company in the Great Lakes Division is being urged to participate in the contest and as a means of aiding companies to arrange their local activities a most useful prospectus has been prepared by the merchandising committee outlining the plan and detailing successful methods of lamp sales used by different companies. Particular emphasis is put upon the value of having all employees join in the campaign through inter-departmental competitions for prizes, supplemented with commission on the actual lamps sold.

The judging of all entrants in the contest of the Great Lakes Division will be made on the following points:

	Weight, Points
1. The total number of lamps sold per total meters connected*	60
2. Average wattage of lamps sold at retail excepting street series lamps	15
3. Percentage of total employees actually selling lamps	15
4. Total dollars of sales per total meters connected*	10

*Items 1 and 4 to be reduced to a comparable basis.

The company receiving the highest rating under this schedule in each of the four states of the Great Lakes Division will be cited as winner of the state contest and the highest rated company in the Great Lakes Division will be cited as winner in the division. To the winner of each state contest there will be awarded a beautiful silver loving cup suitably engraved. Three of these cups will be identical, but the fourth cup, which goes to the state winner, who is also the division winner, will be considerably more elaborate.

Entrance in the contest and reports of results are being made with E. L. Hinchliff, chairman merchandising committee, Commercial Section, Great Lakes Division, N.E.L.A., 72 West Adams Street, Chicago, Ill.

Standard Voltage A.C. Network

Dallas seven-wire system performs well. Troubles are few and voltage complaints unknown. Quality of service justifies added investment

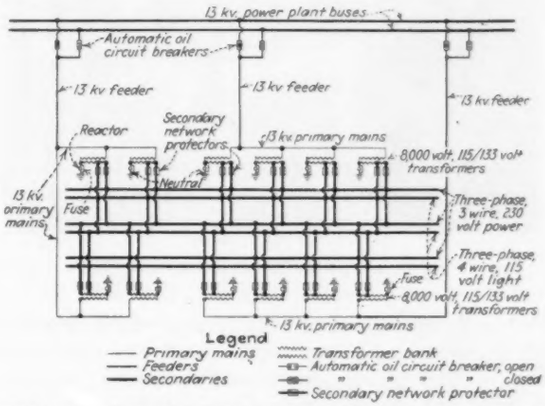
By John Oram

Chief Engineer Dallas Power & Light Company, Dallas, Tex.

THE Dallas, Tex., underground secondary network system is one of the few modern systems which provides standard 115-volt service for lighting consumers and 230-volt for power consumers. This is done by adding an 18-volt secondary coil to the standard 115-volt transformer coil and bringing out three leads on each transformer. With three transformers connected in "Y," the arrangement gives 115 volts for lighting and 230 volts for power service with a common symmetrically grounded neutral.

On account of the high primary voltage used and the relatively short distance of approximately 1 mile from generating station to load center no feeder voltage regulators are required. The range of voltage regulation is about 5 per cent from no load to full load and the control of the generating station busbars by Tirrill regulators is entirely adequate for this purpose. No interference with the remainder of the system is caused, since the major portion of the load follows quite closely that of the underground system, and all other lighting service is controlled by individual feeder voltage regulators in substations.

The Dallas network system covers an area of approximately 0.75 square miles and consists of five 13-kv. underground feeders serving 77 300-kva. transformer banks which supply two sets of secondary network cables,



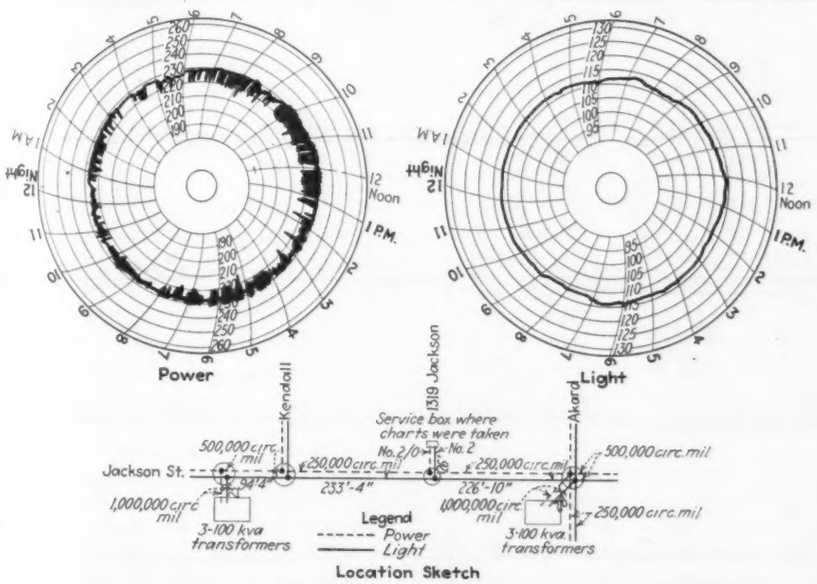
Scheme of design of Dallas underground network

one being the lighting network and the other the power network. Automatic network units are used between transformers and the secondary network system.

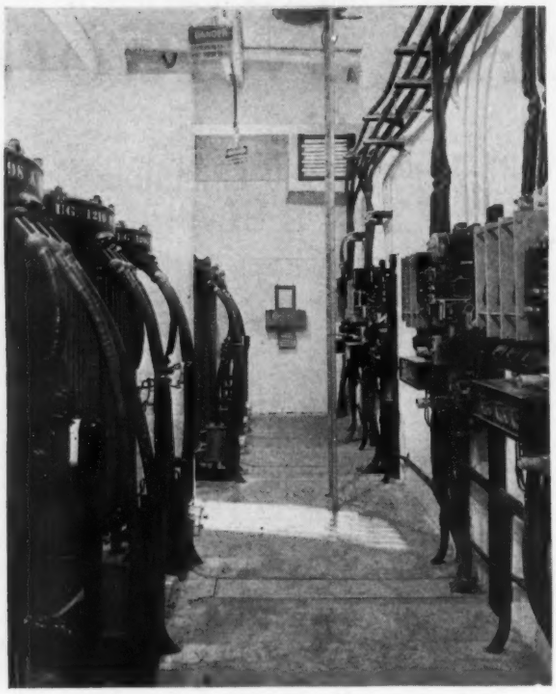
Briefly, the system is composed of three-conductor, 400,000-circ.mil, 13-kv. primary feeders, single-conductor, 250,000-circ.mil, 13-kv. primary mains, 100-kva., 8,000-115/133-volt transformers connected "Y-Y" in transformer vaults located generally under the sidewalks at street intersections, automatic network units, secondary lighting cables consisting of three single-conductor, 250,000-circ.mil cables and one 500,000-circ.mil bare neutral and three 250,000-circ.mil secondary power cables.

All secondary services are tapped off the mains in manholes and service holes and run to the building line, where both power and lighting cables are brought into the same panel box, placed in the front building wall, opening into the street. From the panel in this box all customers' services are taken off.

The decision to use two sets of mains was made after a careful consideration of three factors, namely, investment costs, operating costs and quality of service to be rendered. It was primarily because of the third factor that the seven-wire system was adopted. Previous to the installation of the underground network system the customers of the Dallas Power & Light Company had been furnished with standard 110-volt lighting and 220-volt power service.



Twenty-four-hour voltage charts on power and lighting mains taken at the same location. These charts show no effect of motor starting on lighting voltage



Typical double transformer vault

With the thought of good service and public relations in mind, some secondary network system was sought which would continue to furnish normally standard voltages on both light and power mains. Investigation showed that the additional costs of the secondary portion of the system were offset by the better service provided and the saving in customers' equipment.

In addition to furnishing standard voltage to both lighting and power services the seven-wire system has the advantage that, since two separate sets of mains are used, fluctuations due to the power loads do not cause flickering of the lights. The absence of flicker on the lighting system may be observed from the voltmeter charts taken on lighting and power services in the same distribution box during the same day. All motors up to and including 30 hp. may be started directly across the line without the use of starting compensators. In this way the economy resulting from the simplicity, high performance and balanced design of the common squirrel-cage motor is retained, together with greater flexibility in application where remote control is desired.

Another unique feature of this system is that standard transformers are used with an external reactance installed in the neutral leg of each transformer, so arranged that it is normally shunted by means of a fuse, thereby providing good regulation and lower secondary losses during normal operating conditions. However, when an overload occurs on a transformer bank, due to feeder outage or other abnormal conditions, the fuses blow and thereby insert the external reactance in the circuit and relieve the transformer of part of its load. The location of these reactors may be observed in the picture of a typical double transformer vault here reproduced.

The operation of the entire system since its installation has been very successful. The voltage regulation has been exceptionally good and there have been practically no complaints. The voltage regulation on power and lighting mains along the principal streets is shown on the accompanying chart. The record with reference to continuity of service has, like that for voltage regulation, been satisfactory. The completed network system has been in operation more than a year and during that time no customer has been out of service. During this time a number of faults on primary cables have occurred, but in every instance the trouble has been automatically and successfully cleared without interruption to service. The most severe primary faults were scarcely noticeable on the secondary system except for a momentary drop in voltage. Several secondary cable faults have occurred and burned clear without appreciable effect on the service.

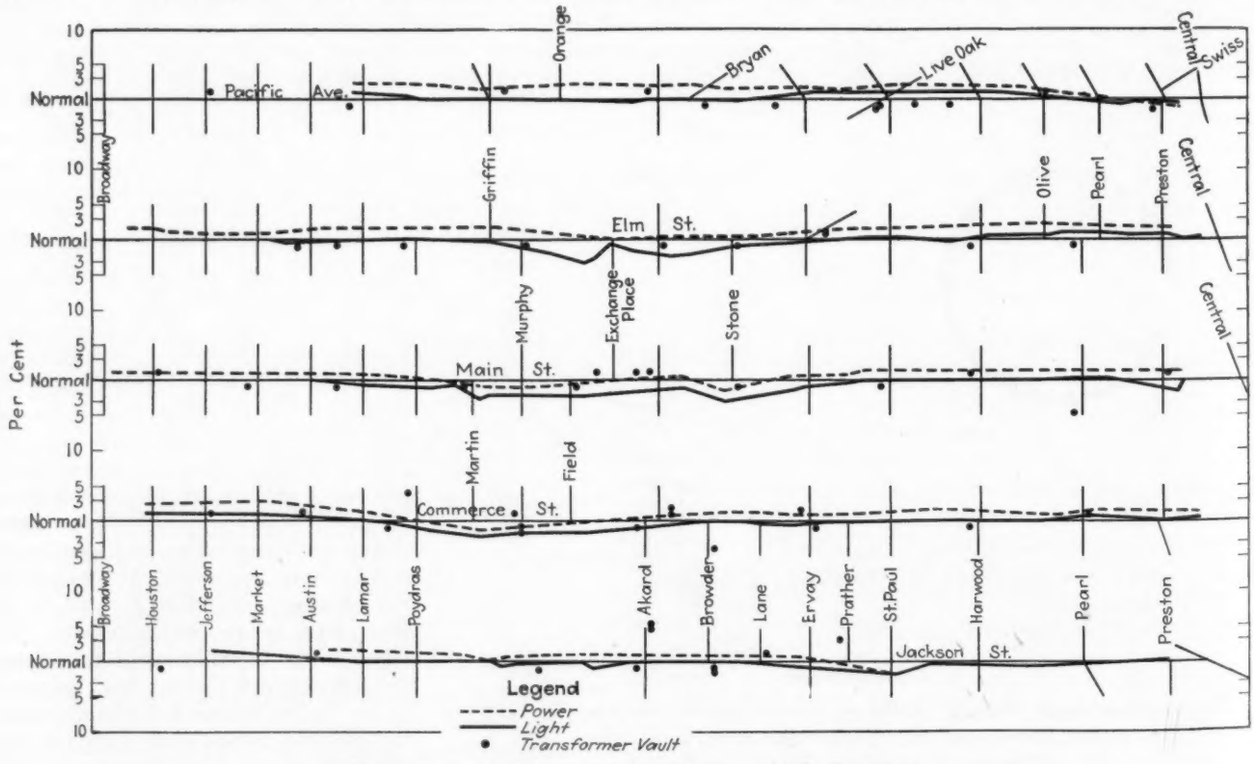


Chart of voltage regulation along principal streets

French High-Tension Lines

THE necessity of developing a thoroughly efficient high-tension system became apparent in France during the war. At that time the government resolved upon a detailed study of the necessity and the best means of transporting electric energy long distances. A very comprehensive plan was developed to provide adequate power for railways, industries and for agricultural needs, taking in virtually all parts of the country, as is illustrated in the accompanying map.

Intracompany Kilowatt-Hour Contest

FOLLOWING out the spirit of the N.E.L.A. slogan "One more kilowatt-hour per month" and the contest among utilities to show increases in residence consumption, the Consumers Power Company, Jackson, Mich., has set up a kilowatt-hour contest in its own organization. The districts of the company are designated as classes A and B, the first, which includes seven districts, having had an average residential consumption of 400 kw.-hr. or more during 1927, while in the second, of eight districts, residential consumption for 1927 averaged below 400 kw.-hr. The prizes in each class are the same. To the superintendents of appliance departments of districts showing greatest and next greatest gains in average residential consumption for 1928 over 1927 will go purses of $150 and $75 respectively.

In order to stimulate the interest of all employees in the contest, additional monthly prizes of $40, $25 and $15 are awarded. Points for these prizes are scored by employees turning in the names of prospective customers to whom electric ranges, refrigerators and water heaters are afterward sold. A refrigerator sale to an employee's "prospect" counts the employee one point, a range two, and a water heater three.

Increases in Revenue from Utilitarian Brackets

By M. Luckiesh
Director Lighting Research Laboratory
National Lamp Works, Nela Park, Cleveland

TO SATISFY the needs of adequate and convenient utilitarian lighting, the lighting equipment of the "average" home should include eight utilitarian brackets. However, our surveys indicate only 2.5 utilitarian brackets per home. The eight brackets would be distributed one in the kitchen (over the sink), two at the bathroom mirror (one at each side), and two (at one of the mirrors) in each of the 2.5 bedrooms of the average home. Inasmuch as these are specified purely from a utilitarian viewpoint, 50-watt lamps are usually necessary.

A 50-watt lamp in an active socket (1,000 burning hours per year), such as over the kitchen sink, increases the average total gross revenue to the central station $3.82, or 13.7 per cent.

A total of five brackets, as used in the 2.5 bedrooms containing 50-watt lamps and considered as average sockets (333 burning hours per year), provide an average annual gross revenue of $6.34. The modern bracket, attachable to mirrors, etc., makes these installations relatively easy.

The two brackets in the bathroom, considered as two average sockets (333 burning hours per year) containing 50-watt lamps each, provide an annual gross revenue of $2.54.

The average annual gross revenue from these eight utilitarian brackets would be $12.70, whereas the average revenue from the existing 2.5 brackets is $3.20 per year. Therefore, eight utilitarian brackets containing 50-watt lamps, and considered to be average sockets excepting the one in the kitchen, should increase the average annual gross revenue from $27.89 to $37.39, or 34 per cent.

These additional brackets would add about 100,000,000 sockets to the central-station lines. The annual renewals for these sockets would be more than 32,000,000 lamps. This is equivalent, in lamp renewals, to all the lamps purchased each year by 4,500,000 average residential customers at the present time.

Ice and Electric Men Co-operate to Sell "Refrigeration"

FOR the second consecutive year all agencies in the city of Portland, Ore., selling ice, mechanical refrigeration or ice boxes have joined hands in an advertising and educational campaign to bring about a more widespread use of refrigeration of all kinds. Activities, which are carried on under the name of the Refrigeration Trades Association of Portland, consisted this spring of a prize contest on May 8-26, conducted by a large local newspaper, for the best slogan under ten words in length conveying the campaign idea and for the best letter of less than 100 words on the subject "Why We Should Use Refrigeration." The slogan chosen was "Keep well by well-kept foods." There were approximately 5,600

entries in the contest, of which 4,500 were for slogans and 1,000 for letters. Cash prizes of $500 were offered with a first prize of $100 in each contest.

During the two weeks from June 11 to 23 an educational campaign was conducted which stressed the all-year value and necessity for refrigeration, whether produced by ice or by any of the many mechanical devices on the market. Among the advertising mediums used were newspapers, window displays, street-car cards, banners and posters.

Membership in the Refrigeration Trades Association includes two power companies, the gas company, ice manufacturers and distributors, all the large department and furnishing stores and makers and distributors of ice boxes, numbering 35 in all.

Unlike many other sections of the country where there is bitter and unethical competition between the ice men and those selling mechanical refrigerators, these groups in Portland feel that the greatest good for all can be accomplished by selling the idea of refrigeration in general, thus creating a larger market all around. Judged by the success which has attended their co-operative efforts, they have chosen a wise policy.

Handy Data for Calculating Energy Required for Domestic Water Heating

Cost and Time Required to Heat Full Tank of Water

Based on Automatic Electric Heater Company units indicated

	Self-Contained Storage				Circulation			
Type heater	1,015	1,030	1,830	1,845	3,415	3,430	3,440	3,450
Size of tank in gallons	10	10	18	18	...	...	...	...
Connected load in watts	1,500	3,000	3,000	4,500	1,500	3,000	4,000	5,000
Time required to obtain full tank of hot water. Cold water from 60 deg. to hot 150 deg.	75 min.	50 min.	75 min.	50 min.	4 hr. 15 min.	2 hr. 10 min.	1 hr. 40 min.	1 hr. 15 min.
Gallons available at bathing temperature (105 deg.) at one draw off	17	17	30	30	50	50	50	50
Kilowatt-hours consumed per month:								
Stand-by consumption	50	50	74	74	123	123	123	123
10 gal. per day	110	107	134	131	187	183	181	179
20 gal. per day	170	164	194	188	249	243	240	238
40 gal. per day	290	278	314	302	371	363	358	356
60 gal. per day	410	392	434	416	490	483	478	475

Above figures x rate = monthly cost.

The 3,430 and 3,450 figures apply when used with 30 gal. insulated tank.

All current consumption figures are based on full automatic operation. These figures would be reduced at least 30 per cent if heater is operated manually or with time control.

All figures are based on a cold water inlet temperature of 60 deg. F. and a room temperature of 70 deg. F. Results will therefore vary in different locations. Southern territories are benefited by lower estimates. It will be noted that the lower wattage heaters require more current to heat a given amount of water, due to a longer heating period and consequently greater radiation loss.

Performance Data on Automatic Electric Heaters

Based on Data Obtained from Automatic Electric Heater Company

Models	4060	4010	4013	4015	6060	6010	6013	6015
Capacity and wattage	40 gal. 600 watts	40 gal. 1,000 watts	40 gal. 1,300 watts	40 gal. 1,500 watts	60 gal. 600 watts	60 gal. 1,000 watts	60 gal. 1,300 watts	60 gal. 1,500 watts
Summary of Initial Heating Tests								
Time required to heat full tank from 60 to 150 deg. F.	14 hr. 9 min.	9 hr. 8 min.	7 hr. 8 min.	6 hr. 6 min.	22 hr. 2 min.	14 hr. 9 min.	10 hr. 3 min.	9 hr. 9 min.
Kilowatt-hours required	8.95	8.95	8.95	8.95	13.4	13.4	13.4	13.4
Heating Efficiency: 97.3 Per Cent								
Cost to heat full tank to 150 deg. F. (based on rate of 2 cents per kilowatt-hour)	0.179	0.179	0.179	0.179	0.268	0.268	0.268	0.268
Cost to heat 1 gal. only	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044
Summary of Radiation Tests								
(Kilowatt-hours required to *maintain* water at 150 deg. F. (in a room having 67 deg. F. temperature)								
Per Hour								
Non-insulated tank	0.728	0.728	0.728	0.728	1.41	1.41	1.41	1.41
Insulated tank	0.141	0.141	0.141	0.141	0.212	0.212	0.212	0.212
Per Day								
Non-insulated tank	17.4	17.4	17.4	17.4	33.8	33.8	33.8	33.8
Insulated tank	3.3	3.3	3.3	3.3	5.0	5.0	5.0	5.0
Per Month (30 Days)								
Non-insulated tank	624	624	624	624	1,015	1,015	1,015	1,015
Insulated tank	100	100	100	100	150	150	150	150
Insulation Efficiency: 85.8 Per Cent								
Estimated Monthly Kilowatt-Hour Consumption Using 10, 20, 40, 60 and 80 Gal. of 150 Deg. F. Hot Water Per Day								
Manual or timed operation	166	166	166	166	166	166	166	166
Full automatic operation	255	255	255	255	290	290	290	290
Using 20 gallon								
Manual or timed operation	235	235	235	235	235	235	235	235
Full automatic operation	300	300	300	300	330	330	330	330
Using 40 gallon								
Manual or timed operation	369	369	369	369	369	369	369	369
Full automatic operation	440	440	440	440	467	467	467	467
Using 60 gallon								
Manual or timed operation	400	400	400	400	400	400	400	400
Full automatic operation	465	465	465	465	490	490	490	490
Using 80 gallon								
Manual or timed operation	...	536	536	536	...	536	536	536
Full automatic operation	...	600	600	600	...	630	630	630

Savings per Month of 720 Hours, with Hot Water at 136 and 150 Deg. F., and Room Temperature of 55 Deg. F.

Submitted by Automatic Electric Heater Company as based on tests made by Mellon Institute of Industrial Research

Dollars	30 Gal. Cost of Electricity per Kilowatt-Hour			40 Gal. Cost of Electricity per Kilowatt-Hour			50 Gal. Cost of Electricity per Kilowatt-Hour			60 Gal. Cost of Electricity per Kilowatt-Hour		
	0.02	0.03	0.04	0.02	0.03	0.04	0.02	0.03	0.04	0.02	0.03	0.04
Savings by using Sepco tank cover, water at 136 deg. F.	7.07	10.60	14.14	8.31	12.47	16.62	9.23	13.85	18.45	10.10	15.15	20.20
Cost to maintain water at given temperature with boiler insulated with Sepco tank cover, water at 136 deg. F.	5.17	7.75	10.32	6.07	9.11	12.14	6.73	10.10	13.48	7.38	11.07	14.75
Savings by use of Sepco tank cover with water at 150 deg. F.	8.43	12.65	16.85	9.90	14.86	19.82	10.54	15.80	21.10	12.05	18.05	24.10
Cost to maintain water at 150 deg. F. with boiler insulated with Sepco tank cover	6.16	9.23	12.30	7.23	10.85	14.47	8.02	12.03	16.03	8.80	13.20	17.60

NOTE—There will be a material saving when water is kept at 136 deg. F. over the cost to keep it at 150 deg. F. It averages about $1 per month difference on 0.02 rate; $2 on 0.03 and $3 on 0.04 rate with 30-gal. boiler.

Improving Machine Shop Illumination

Lack of uniformity in working procedure complicates determination of requirements. Tests indicate distribution and intensity values must be co-ordinated

By Arthur A. Brainerd
Philadelphia Electric Company, Philadelphia, Pa.

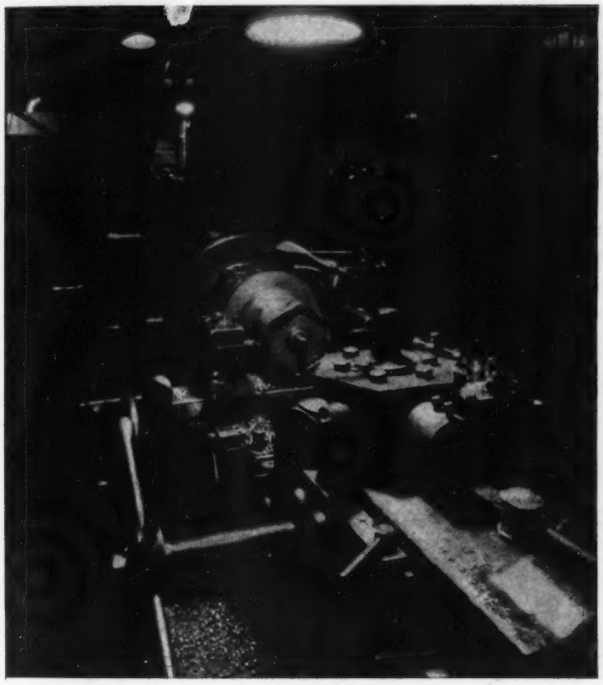
ONE OF the most difficult tasks confronting the lighting service engineer is the illumination of machine-tool operations. There are two reasons for this: First, because of lack of standardization in the operations performed, it is hard to determine by test just what is the best system of illumination; second, for the same reason, it is hard to demonstrate to the customers' satisfaction that the change recommended is desirable.

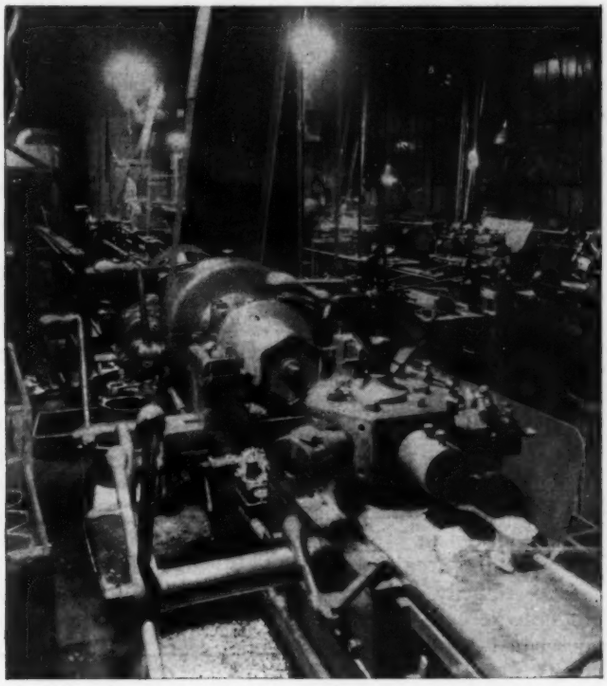
The typical machine-tool shop is lighted by a nondescript array of small reflectors of the tin-cone type, hanging at the end of drop cords over the machines and equipped with bare lamps varying anywhere from 25 to 200 watts in size. In most cases these local lamps are supplemented by a feeble attempt at general illumination, using shallow bowl or possibly R.L.M. domes, generally underlamped. There is usually no attempt made at adequate maintenance. In endeavoring to remedy such conditions, many lighting engineers have recommended general illumination of high foot-candle intensity with no special reference to the direction of light upon the particular operation. In fact, we frequently hear the statement that "when in doubt, place 200 watts on 10-ft. centers."

A study of the various tests made in the field of the effects of illumination on production will show that there is no logical reason whatever for believing that such a system is the proper one. In most tests, records have been kept of changes in foot-candle intensity alone, and all increases in production have been ascribed to this cause, although there are at least five other variables which must be considered in rating any system of illumination.

There is no question but that with any well-designed lighting plan an increase in foot-candle intensity in the working area will increase production up to a certain point, but there is no virtue whatever from a production standpoint in raising the foot-candle intensity of the aisles and passageways above 4 or 5 foot-candles. The trouble with some systems of general illumination is that they concentrate the highest level of illumination in the passageways where light intensity is of least value.

The writer recently had occasion to inspect the lighting in a large mill covering an entire city block. The illumination system was of the same type as described above, using 200-watt lamps on approximately 10-ft. centers. Although the average intensity was 14 foot-candles, since the regular arrangement brought most of the units between the machines, the intensity in the aisles was 20 foot-candles and the intensity on the working area averaged less than 5 foot-candles. The superintendent of this plant had previously called upon two other lighting engineers on separate occasions and they were unable to suggest any improvement for the system.





Installation of a proper type of fixture and the selection of correct intensities for machine shop illumination led to the improvement indicated. Dense shadows and glare eliminated under new conditions

In view of this situation it seemed advisable to make some investigations as to just what is the correct way to light a machine tool. Obviously, the requirement which must be met in this class of work is the ability to read a micrometer readily and without eyestrain. Experiments, with expert machinists using a lighting source which was adjustable, showed that well-diffused light of not less than 21 foot-candles in intensity was required for this critical task.

If we consider the working area for a lathe as being

about 4 ft. in diameter, the result desired can be realized by hanging an R.L.M. dome with a bowl-enameled 150-watt lamp mounted about 7½ ft. above the floor, above and slightly in front of the operator's right shoulder. This position seems to be the most satisfactory from the point of shadows and direct and reflected glare. Other machine tools must be standardized accordingly. It has been found that if this general plan is followed out, using at least one and sometimes two 150-watt or 200-watt R.L.M. domes with bowl-enameled lamps to each machine, an average intensity of from 20 to 30 foot-candles will be secured in the working areas and sufficient light in aisles and passageways for safety. Such a system, using units hung slightly lower than a uniform general system requires, concentrates the highest intensity where it is needed the most.

In order to determine with as much accuracy as possible the actual effect on production of this system of illumination, it was decided to conduct a test, providing that some suitable location could be found. The conditions necessary for a successful test of this nature are a routine operation extending over a considerable period of time and full co-operation on the part of the management, workmen and foremen. These conditions were found to exist in one section of the plant of the American Metal Works, Germantown, Pa. An order was received to finish several thousand castings of a certain kind of valve seat on a turret lathe. The task consisted of picking up the rough castings, inserting them in the lathe, completing four operations with as many different tools and removing from the lathe. Careful stop-watch tests showed that only 37.2 per cent of the time was spent in performing manual operations whose speed depended upon seeing, although severe glare conditions caused the operative to become sleepy. Under these conditions no great over-all increase in production was to be expected.

The existing system of illumination for this machine was the usual dingy, deep cone shade with a 50-watt lamp, giving an average foot-candle intensity of 11.6 in the working area and a variation range of 7.5 to 1.

To remedy this condition, an R.L.M. dome was mounted 7½ ft. above the floor in the general manner described above. Arrangements were made to obtain foot-candle intensities of 7.4, 14 and 20 throughout the working area with a variation range of only 1.3 to 1.

Importance of Light Distribution

In order to test the effect of distribution, the first intensity used was 7.4 foot-candles. A careful study under these conditions showed an increase in production of 2.25 per cent, although the foot-candle intensity was decreased 36 per cent. Two other tests conducted at levels of 14 and 20 foot-candles showed production increases of 6.7 and 12.4 per cent over the original lighting system. In the last two cases nothing was changed but foot-candle intensity. The standardized job was completed at the end of the 20 foot-candle test.

The most remarkable feature in these results is the fact that improving the quality of the light had more effect on increasing production than did increasing intensity, since but a 20 per cent increase in foot-candle intensity brought about an increased production of 6.7 per cent and the total increase was only 12.4 per cent.

Results such as these show conclusively that dividing a factory room up into squares and placing a light in the center of each square is not necessarily good engineering. No doubt there are conditions where ceilings are high and machines are individually driven where the proper quality of illumination can be secured with a uniform general system, but such is not the problem of thousands of belt-driven machine shops where the operatives are straining their eyes under poor illumination.

Letters from Our Readers

Accurate Results with Calculating Table

To the Editor of the Electrical World:

In the Electrical World for June 23, 1928, there is a letter from Prof. L. S. Foltz under the heading "Securing Accurate Results with Calculating Table." Professor Foltz states that his method properly allows for the quadrature relation and yields a true value for short-circuit currents. However, he tacitly makes an assumption that resistances and reactances can be combined independently. This is justified only in the case of series circuits. In the case of parallel circuits it is necessary to use the equivalent conductances and susceptances, so that resistances in parallel circuits cannot be combined correctly unless the reactance values associated with them are considered.

Take, for example, two parallel circuits, one having an impedance $r_1 + jx_1$, and the second an impedance $r_2 + jx_2$.

The currents through each circuit are:

$$I_1 = \frac{E}{r_1 + jx_1} = E\left\{\frac{r_1 - jx_1}{r_1^2 + x_1^2}\right\}$$

$$\text{And } I_2 = \frac{E}{r_2 + jx_2} = E\left\{\frac{r_2 - jx_2}{r_2^2 + x_2^2}\right\}$$

$$\text{The total current } I = E\left[\left\{\frac{r_1}{r_1^2 + x_1^2} + \frac{r_2}{r_2^2 + x_2^2}\right\} - j\left\{\frac{x_1}{r_1^2 + x_1^2} + \frac{x_2}{r_2^2 + x_2^2}\right\}\right]$$

According to Professor Foltz's method, the resistances and reactances are combined independently, thus:

$$R = \frac{r_1 \times r_2}{r_1 + r_2} \qquad X = \frac{x_1 \times x_2}{x_1 + x_2}$$

$$\text{And the total current } I = E\left\{\frac{R}{R^2 + X^2} - j\frac{X}{R^2 + X^2}\right\}$$

By substituting the values of R and X in the second formula for I, it is readily seen that it does not check with the first formula.

As a simple numerical example take:

$r_1 = 3 \quad x_1 = 4 \quad r_1^2 + x_1^2 = 25$
$r_2 = 4 \quad x_2 = 3 \quad r_2^2 + x_2^2 = 25$

Then $I_1 = E\,(0.12 - 0.16j)$
$I_2 = E\,(0.16 - 0.12j)$
And $I = E\,(0.28 - 0.28j)$

According to Professor Foltz's method:

$$R = \frac{3 \times 4}{7} = \frac{12}{7} \qquad X = \frac{12}{7}$$

$$R^2 + X^2 = \frac{288}{49}$$

$$\text{and } I = E\left\{\frac{7}{24} - \frac{7}{24}j\right\}$$

$$= E\,(0.2917 - 0.2917j)$$

The error in this case is about 4 per cent, and in most practical cases it would be less than this. I, therefore, feel that Professor Foltz's method would probably give closer results than the method of disregarding resistance entirely in the case where overhead and underground systems are combined, but it is still an approximate method.

John R. Dunbar,
Electrical Engineer.
Canadian Westinghouse Company,
Hamilton, Ont.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Boilers, Superheaters and Economizers. — The design tendency of power stations in the last few years has been toward greater size in turbo-generators and higher steaming capacity in boilers. The tendency of design in these large boiler units has been toward higher efficiency at higher ratings and the maintenance of these ratings over long periods of time. New problems of operation have, therefore, been presented requiring new methods and new types of boiler apparatus. Statements by operating companies regarding boiler installations in several stations, and recorded data in connection with soot blowers, moisture in steam, steam velocities in superheaters, and protective coatings for interior of boiler tubes and drums have been included. Manufacturers' statements have also appeared in this report as to boilers, superheaters, economizers, soot blowers, feed-water regulators, valves, water columns and gages, steam purifiers, high pressure drainage control, and allied subjects.—*Serial Report, National Electric Light Association,* July, 1928.

Generation, Control, Switching and Protection

The Relation Between Transient Reactance and Negative Phase Sequence Reactance of An Alternator.—S. BEKKU and M. URUSHIBATA.—In a previous article the authors demonstrated that the transient impedance of an alternator just after the occurrence of a short circuit is equal to the negative phase sequence impedance in the sustained state. In the present discussion this proposition is verified theoretically for an ideal alternator of zero resistance. This neglecting of resistance amounts to an acceptance of the constant linkage theorem which infers equality of the negative phase sequence impedance and the transient impedance just after the occurrence of the short circuit. The transient reactance is shown to be approximately equal to the sum of the armature leakage reactance and the field leakage reactance reduced to the armature winding.—*Journal of Institute of Electrical Engineers of Japan,* July, 1928.

Steam Station D'Ivry.—L. VELLARD.—A new generating station near Paris has recently been completed. This plant operates in parallel with the other Parisian plants at 10,500 volts three-phase 50 cycles. The present capacity of 60,000 kw. can be augmented by additional units up to 150,000 kw., reaching the limit of the available space. Four turbo-generators of 15,000 kva. at 3,000 r.p.m. represent the main units, while two geared sets of 680 kva., 6,900 to 1,000 r.p.m. provide the auxiliary power requirements of the station. A carefully laid out system of circulating the condensed water for purposes of preheating the boiler feed water accounts for an unusually high thermal efficiency of this modern steam plant. A completely housed switching station, with main circuit breakers of 600,000 kva. rupturing capacity, controls ten main feeders. — *Revue Générale de l'Electricité,* June 30, 1928.

Steam Station Fenne.—CH. DUVAL.—An up-to-date "mouth of the mine" steam plant has recently been finished at Fenne, near Saarbrucken, in the Saar coal region. The station is at present equipped with two turbo-generator sets of 15,000 kva. and one unit of 31,000 kva., to which will be added shortly another 31,000 kva. set. Two banks of 20,000 kva. and one of 40,000 kva. transform the output of the three generators from 11 kv. to 35 kv., supplying at present nine feeders to four main mining districts. An interesting feature of the station is a cable testing outfit, consisting of a 320 hp. induction motor connected to a single phase generator, which feeds a 3,000/52,500 volt transformer. During cable testing this set can furnish up to 322 kw. The station uses chiefly low grade coal and mine refuse, and an elaborate conveying system joins mines to plant. A storage yard for 50,000 tons of this fuel has been provided. — *Revue Générale de l'Electricité,* July 14, 1928.

Transmission, Substations and Distribution

Some Practical Considerations in the Design of Automatic Equipments for Heavy Traction Substations. — H. B. POYNDER.—The author has endeavored to indicate some of the problems which still await satisfactory solution in the application of the automatic rotary-convertor substation to heavy electric traction. The need for overhauling present designs, with a view to decreasing maintenance, is pointed out, and the phenomena which occur on short-circuiting a rotary convertor are discussed. Among the other topics treated are: The high-speed breaker and its advantages, the importance of sufficiently insulating series windings, the effect of high ambient temperature on machine output, the use of air filters, the type of opening which gives free egress for the air, method of ventilating the armature core, the design of vertical convertors, thermal relay problems, and the means available for obtaining control current for the operation of automatic equipment.—*The Institution of Electrical Engineers (England),* July, 1928.

Long Distance Transmission. — G. MARKT.—The high capacitance of long transmission lines, which are insulated for and operated at high potentials, and the finite velocity of electromagnetic waves, occasion phenomena unknown on comparatively short lines. While formerly the center of attention was focused on the generating end, the main problem is now transmission, control and voltage regulation, all of which may in turn react upon the design of the generator and transformer. The author gives a mathematical and vectorial account of the salient phenomena for lines operating with 110 to 440 kv. and a length corresponding to quarter or half wave length. The graphical representation is both novel and exceedingly clear. The explanation of the Ferranti phenomenon; that is, the voltage increase along the line under certain conditions, has been well handled. Numerical values, taken from hypothetical and actual lines, contribute greatly to the value of the paper. Data on conductors, insulators and towers for extremely high voltage lines are given. —*Elektrotechnik und Maschinenbau,* June 17, 1928.

Units, Measurements and Instruments

The Herbert Cloudburst Hardness Testing Machine.—A process of hardness testing which consists essentially of allowing a stream of small, hard steel balls to fall in the form of rain on a hard steel surface has been developed. Given the right conditions, it is said that the rapid succession of blows causes a thin, super-hardened layer to be produced on the steel surface. While the Cloudburst process was intended primarily as a means for producing super-hardness, another application of equal importance was subsequently revealed. A case-hardened steel surface exposed to the rain of balls, any portion of which has not been properly hardened, will become indented. This places in the hands of manufacturers a new method of testing for hardness, and its chief value lies in the fact that hardened surfaces may be tested all over without marking them, except on the soft spots. A machine devised to operate in accordance with the principle just mentioned has been manufactured abroad and is described fully in this article.—*Engineering (England),* July 6, 1928.

Heat Applications and Material Handling

Arc-Welded Construction for Compressors.—W. C. MAKLEY.—The use of rolled, drawn and pressed steel components in building up compressor cylinders and frames by arc welding offers several important advantages, according to the author. The proposed design involving greater safety, lower cost and weight, and the elimination of defective castings. This discussion, while refer-

ring particularly to air or ammonia compressors, offers an indication of the possibilities of arc welding to hitherto unassayed tasks, and indicates the saving realized for certain work. The reduction in weight is said to amount to approximately 50 per cent of the total weight of the unit, without any reduction in the factor of safety, and substantial saving in manufacturing costs are involved in the elimination to a large extent of losses due to faulty or defective material, sometimes determined as unsuitable for use only after expensive machine operations have been performed. —*American Machinist,* August 9, 1928.

Copper and Nickel Plating With One Handling.—What is said to be the first full-automatic installation for the continuous plating of steel radiator shells with both copper and nickel, in which the buffing of the copper-plated surface has been eliminated, is described in this article. Many unique features have been incorporated in the equipment, both mechanical and electrical, and in the solution control. The details of the process are described. Electrical energy for the plating machine is furnished by two generators of 6,000 to 7,500 amp. capacity respectively, and the arrangement and control of the electrical equipment has added to the economies secured.—*American Machinist,* August 9, 1928.

Electrophysics, Electrochemistry and Batteries

Pressure Electrolysis of Water Eliminates Need for Compressors. — J. E. NOEGGERATH.—The commercial possibilities in the production of gases which may be obtained through electrical dissociation have been pointed out by the author. Previous laboratory determinations have been reviewed and the various factors involved in the production of hydrogen and oxygen from water through an adaptation of the high pressure process have been covered. Among the advantages of the pressure dissociator are high efficiency, small and inexpensive construction, high purity of gases, economy of space, low cost of housing, elimination of the necessity for compressors, minimization of labor cost and flexibility of manufacturing features. — *Chemical and Metallurgical Engineering,* July, 1928.

The Direct-Current Transformer Utilizing Thyratron Tubes.—D. C. PRINCE. —Thyratrons or high-vacuum three-electrode valves may be utilized by means of a suitable circuit arrangement to convert direct current into alternating current in a manner the reverse of that in which a rectifier can convert alternating current to direct current. In developing the inverter, the transfer or commutating problem was solved in such a way that the current reverses naturally, leaving to the pliotron grid only the function of holding the current at zero until it flows again. The inverter is said to be particularly well adapted for converting direct-current power into alternating-current power at the usual commercial frequencies except for the losses that result from the present rather high space charge drop in the pliotrons. A recent development has eliminated some of the difficulties involved and the author has endeavored to point out the limitations and possibilities in the investigation and potential application of such equipment.—*General Electric Review,* July, 1928.

Traction

Express Passenger Electric Locomotives.—The Great Indian Peninsula Railway is at present engaged in a scheme of main line electrification covering lines where heavy gradients are encountered. The details of the new high-speed electric passenger equipment with special individual axle, flexible drive, are described. Twin armatures have been utilized for the main motors and electro-pneumatic control provided. Each of the twin armature type main motors is supported on the main frames, and each armature has a pinion meshing with a common gear wheel mounted on the quill. The quill itself is carried in bearings housed in the motor frame. Thus accurate meshing of the teeth and constancy of the gear centers are easily maintained. The flexible drive mechanism is mounted at the opposite end of the motor frame from the gear wheel, and is coupled to heavy pins on the driving wheel. The torque is accordingly transmitted from the motor pinions, through the gear wheel to the quill, thence through the flexible yoke drive to the adjacent driving wheel, and subsequently through the axle to the other driving wheel of the pair on that axle. The automatic and protective features of this equipment are fully described.—*Electrician* (England), Aug. 3, 1928.

Telegraphy, Telephony, Radio and Signals

Carrier Systems on Long-Distance Telephone Lines.—H. A. AFFEL, C. S. DEMAREST and C. W. GREEN.—This paper describes developments which have resulted in improvements in the carrier telephone art during the past few years. A new system is discussed in detail, together with suitable repeaters and pilot channel apparatus for insuring the stability of operation. Line problems are considered and typical installations reviewed. The growth of the application of carrier systems and their increasingly important part in providing long-distance telephone service are also shown.—*Bell System Technical Journal,* July, 1928.

Use of a Moving Beam of Light to Scan a Scene for Television.—F. GRAY. —This paper is a discussion of a method of scanning employed in a television system. A three dimensional subject is scanned directly by a moving beam of light to produce a picture current in photoelectric cells. This method permits the use of an intense transient illumination and more than one large aperture photoelectric cell to collect reflected light. These two factors give a highly efficient optical system for producing a picture current at a transmitting station. The image seen at a distant station is the same as if the light came out of the photoelectric cells to illuminate the subject and a small aperture lens formed an image of the subject for transmission. The television system transmits only the special variations of brightness and not the absolute brightness of the view. Consequently, an additional steady illumination of a subject does not affect the reproduced image.—*Reprint B-301, Bell Telephone Laboratories, Inc.*

Miscellaneous

Coke Oven Locomotive.—H. LUTZ. —The receiving car for coke, discharged from a multi-unit coke oven, has to be moved on a track in front of the oven from unit to unit, according to the operating cycle of the ovens. An electric mule is described in this article, specially built for this rough but exacting service. To give the operator a clear view, the engine is built higher than it is long. The absence of direct current made it necessary to choose between three-phase or single-phase current. The latter was chosen for the sake of simplicity, using one commutator brush-shifting motor of 46 kw., which drives the two driving axles through two worm wheels. Starting, regulation and reversal are all accomplished by the shifting of the motor brushes.—*Brown, Boveri Mitteilungen,* July, 1928.

The Problem of Storage for Flood Control and for Power Development.— DANIEL W. MEAD.—The actual use of storage reservoirs will, the author states, give the clearest idea of the feasibility of the combined use of storage for flood control and for power purposes. That reservoirs under favorable circumstances may be used successfully for both flood prevention and water powers, is demonstrated by the regulation of the rivers of the Great Lakes System. Particulars regarding the Great Lakes and St. Lawrence River reservoir systems as well as irrigation and flood prevention have been analyzed, and it is concluded that: approximately complete control of the river system is of definite advantage to both flood prevention and water power development, but that such control is practically impossible by artificial means on any large river system; that with partial control on any system, the combined use of reservoirs for flood protection and other purposes is so antagonistic as to be inexpedient; that reservoirs for whatever purpose they may be constructed will have minor favorable effects for most other purposes, in that they will tend to equalize the stream flow; and that in general resevoirs should be built and operated for a single purpose when found financially advantageous for such purpose, and that with a few exceptions the use of reservoirs for combined services is not warranted except when they can be so used as not to interfere with the purpose for which they were constructed.—*Mechanical Engineering,* August, 1928.

News of the Industry

Sloan Made President of New York Edison

Brady Will Be Chairman of the Board of Directors, Murray Vice-Chairman of the Board and Lieb Senior Vice-President of the Company

IN LINE with plans to bring all the electric operating subsidiaries of the Consolidated Gas Company in Greater New York under a common executive management, Matthew S. Sloan, president of the Brooklyn Edison Company —which, barring any unexpected delay caused by the New York Public Service Commission, will very soon be numbered among these subsidiaries—was on Tuesday, Aug. 28, elected by the directors of the New York Edison Company president of that corporation. He will succeed Nicholas F. Brady, who resigned to accept the newly created office of chairman of the board of directors. Mr. Brady is already chairman of the Brooklyn Edison Company, over which Mr. Sloan will continue to preside.

The directors of the New York Edison Company also elected Thomas E. Murray, formerly senior vice-president, vice-chairman of the board of directors, while John W. Lieb, formerly vice-president, was elected senior vice-president of the company.

The announcement of Mr. Sloan's election as president of the New York Edison said that he would be in complete charge of all operations and management. As the head of the two Edison companies he will therefore direct the business and policies of one of the largest concentrated electrical properties in the world after an unusually successful and rapid rise. Eventually it is the desire to segregate the electric and gas properties of the Consolidated Gas Company financially, but no change will be made now in this regard. George B. Cortelyou will remain at the head of Consolidated Gas.

Mr. Sloan's Career

Mr. Sloan was born in Mobile, Ala., in 1881 and became associated with electrical companies in the South after his graduation from the Alabama Polytechnic Institute in 1901. After a short connection with the General Electric Company he entered the utility field as chief engineer of the Birmingham Railway, Light & Power Company, subsequently being made assistant superintendent of the lighting and power departments, and in 1907 he was appointed superintendent of power. Another promotion followed in 1908, when he became superintendent of the company's electric department in charge of the operation and commercial sales of that department. In 1910 he was made assistant to the president with supervision over all departments. He became affiliated with the New Orleans Railway & Light Company as assistant to the vice-president in 1913, later was made manager of the railway and electrical departments, and in 1917 became vice-president and general manager.

Not long after this Mr. Sloan resigned to join the New York Edison Company as assistant to Vice-president John W. Lieb and in that capacity became operating manager. When Nicholas F. Brady resigned as president of the Brooklyn Edison Company in 1919 Mr. Sloan was appointed to succeed him, and since that time he has been the company's chief executive. Under his presidency the company has gone ahead by leaps and bounds. Its output has more than doubled in six years, and in 1927 the company fell just below the billion-kilowatt-hour group.

Matthew S. Sloan

Mr. Sloan has always been an indefatigable worker in the industry. While in the South he was an outstanding figure in the Southeastern Section of the National Electric Light Association, and after moving North he won an enviable reputation as an authority on public relations. In 1924 he was appointed chairman of the Public Relations National Section, N.E.L.A., by President F. T. Griffith. In 1926 he was elected a vice-president of the association at the annual convention. He is now the ranking vice-president and will, in the ordinary course of events, succeed to the presidency next year. He is past-president of the Association of Edison Illuminating Companies and of the Empire State Gas and Electric Association and was for several years chairman of the public utility information committee of the latter association.

Peace Reigns Once More at Los Angeles

Southern California Edison Company and City Bureau Settle Out of Court Three Controversies of Long Standing—City Will Not Build Steam Plant

FIVE separate lawsuits involving long-standing controversies between the Los Angeles Bureau of Power and Light and the Southern California Edison Company have been amicably settled out of court, according to statements issued by officials of the Edison company and the bureau. Both parties give credit for the settlement to the peace-making efforts carried on for several months by a Los Angeles attorney, Herbert J. Goudge, acting in the capacity of citizen and friendly intermediary and not as the attorney or representative of either side.

The lawsuits settled covered three separate controversies, one involving the proposed construction of a steam plant by the city at the harbor, another relating to an accounting for taxes under the so-called operating agreement between the city and the Edison company, and the third concerning the proper method of billing wholesale power furnished by the company to the city.

Two of these suits were brought by the Edison company to enjoin construction by the city of a steam generating plant. To adjust this controversy, the Edison company has agreed to provide and set aside for the service of the city, in lieu of the 25,000-kw. plant which the city itself proposed to construct, one of the 35,000-kw. steam units at the company's Long Beach steam plant No. 2, such unit to be isolated from the Edison system, to be directly and exclusively connected with the city system and to be available to the city at all times up to full capacity. It is stated that by this means the city will acquire the steam plant service it needs without the investment of $3,500,000 for its own separate plant and will also save annual operating and maintenance costs amounting to more than $300,000 a year. Pursuant

to this understanding, the city Water and Power Board has made arrangements for the cancellation of contracts entered into by it some time ago for steam-plant machinery.

The accounting suit brought by the city involved the allowance which the Edison company should have as a credit for state taxes paid by it in connection with its operation of the city system during the period of the so-called operating agreement between the company and the city, which was in force from May 1, 1917, to May 16, 1922.

The other matter on which settlement was reached involved the proper method by which charge for wholesale energy furnished by the company to the city should be billed. This had led to two suits. The company claimed $900,000 and the city admitted $600,000. The contested $300,000 represented the difference between the total amount of bills figured according to the method contended for by the company and the method supported by the city. The company has been making delivery of energy to the city at five different points and has been rendering bills on that basis, while the city has contended that the billing should be made on the basis of one point of delivery. These suits also involved, by way of offset, a large counter-claim filed by the city for damage asserted to have been suffered by the city on account of alleged irregularities in electric service. Under the agreement reached the company drops its suits and the city withdraws its counter-claims.

R. H. Ballard, president of the Edison company, expressed his satisfaction with the settlement, saying: "The amicable adjustment of these points of dispute is in the best interest of all concerned and opens the way for immediately adding to the power resources of Los Angeles. With these controversies out of the way, the Edison company will start at once on the construction of an additional 125,000-hp. generator at its Long Beach plant similar to the one just completed. This will require an investment of $7,000,000. We are also starting work on a connection between our steam plant and the city's distribution station at Wilmington, a project involving nearly $400,000 and which will be completed in two months."

Chief Electrical Engineer E. F. Scattergood of the Bureau of Power and Light said: "I believe the settlement is a very happy one. It opens the way to far more effective co-operation between the Bureau of Power and Light and the Edison company—a condition that will result in very great benefit to the community as a whole."

Spokane A. I. E. E. Convention Opens

Pacific Coast Technicians Discuss Calibration of Arc-Over Voltages, Neon Gas-Tube Research, Automatic Substations, Electrification, Electrolytic Zinc and Stability

OPENING with a student session on Tuesday morning, two hundred and fifty engineers gathered at Spokane this week for the Pacific Coast convention of the American Institute of Electrical Engineers. President Schuchardt in his opening remarks highly indorsed the holding of one meeting yearly on the Pacific Coast because of the outstanding accomplishments of electrical engineers of that section.

The first technical session, on Tuesday afternoon, opened with a paper by J. S. Carroll and Bradley Cozzens in which results of determining sphere-gap and points-gap arc-over voltages by direct measurement were given. Current through a water resistor was recorded on an oscillograph giving results believed to be within 2 per cent accurate in measuring more than 1,000,000 volts to ground at the Ryan high-voltage laboratory. The authors concluded that points gap can be used for 60-cycle voltage measurements with an error of less than 10 per cent and that the rapid decrease in kilovolts per inch necessary for the breakdown of gaps in excess of nine feet to ground establishes an approximate economic limit of high-voltage transmission based on present design practice.

Valuable data were given in a paper by F. O. McMillan and E. C. Starr showing the values of capacitance needed to improve power factor of gaseous conductor signs by use of parallel capacitance on the low-voltage side or series capacitance in the high-voltage circuit. D. W. Proebstel said that his company found in recent tests on neon gas signs power factors ranging from 18 to 40 per cent. Several others who discussed the paper felt that the burden of power-factor correction should rest on the sign manufacturer.

Features of design and the field of application of the automatic substation were discussed in a paper by S. J. Lisberger. Several who discussed the paper pointed out that the application of automatic stations is purely a matter of economics, and all agreed that automatic equipment has been developed to the point where a very high degree of reliability may be expected, giving automatic stations a wide range of application between the very large manual stations and the small non-automatic distribution stations. Economic arrangement of equipment to facilitate quick inspection and location of faults and to reduce fire risk were points stressed.

The new electrolytic zinc plant of the Sullivan mining company at Kellogg, Idaho, was described by E. R. Fosdick. The plant has a capacity of 50 tons of zinc per day and requires 16,000 amp. of direct current supplied by two three-unit motor-generator sets having a synchronous motor driving two 500-volt direct-current generators. To permit refinements in metallurgical processes to be made without radical changes in the initial installation, great care was used in selection and installation of equipment to admit of flexibility of plant operation.

A paper by R. H. Park and E. H. Bancker on system stability as a design problem reviewed the factors affecting stability, including generator short-circuit ratio, voltage regulators, excitation systems, etc. Methods of calculating stability were discussed, and a number of examples were given to show the method of application.

One of the papers presented at the second session, on Wednesday morning, dealt with the electrification of the main line of the Great Northern Railway over the Cascade Mountains in western Washington. This electrification is of particular interest because it takes current at 25 cycles and 11,000 volts from the contact line and through a motor-generator set on the locomotive converts it to 600 volts direct current for the traction motors. Those who discussed the paper touched on such points as interference with communication circuits due to the 25-cycle track currents and the moot question of the advantages of the straight direct-current locomotive as against the motor-generator type.

A paper dealing with the several systems of automatic block signaling, particularly the alternating-current system, was presented by C. F. King, Jr. Very satisfactory operation of a double-unit automatic mercury-arc rectifier substation for railway service on the system of the Los Angeles Railway was reported in a paper by L. J. Turley. Discussion brought out the fact that a 1,500-kw., 1,200-volt rectifier installation by the Portland Electric Power Company has been giving entirely satisfactory performance during more than a year of operation and that the success of installations for railway service is leading to a serious consideration of mercury-arc rectifiers for the relatively lower voltages employed in Edison three-wire networks.

On Wednesday evening an interesting lecture was presented by Dr. C. E. Magnusson of the University of Washington on Lichtenberg figures. Two technical sessions each were scheduled for Thursday and Friday, to be followed by inspection trips to points of interest on Saturday.

New York Power & Light's 60-Cycle Changes

The New York Power & Light Corporation has announced a continuation of its present program begun a few years ago when changes were made from 40-cycle operation to the standard 60-cycle. The work on the new program will include $3,000,000 worth of construction and will effect the complete change of the Albany and Cohoes district to 60-cycle equipment.

A new 10,000-kw. transformer will be added to the Menands substation and a 13,200-volt transmission line will connect this station to the Riverside steam

station. New equipment will be placed in use for Albany's 4,000-volt distribution system. The program also includes new submarine cables from Rensselaer to Albany and major changes at the Trinity Place and Partridge Street substations.

At Cohoes the company's 54,000-hp. hydro station, originally designed for 40-cycle operation, is being changed to 60-cycle. This requires changes of major portions in the switching structures and auxiliary equipment generally. At Schenectady a new 13,200-volt incoming feeder is being provided at the Dock Street substation. Additional 4,000-volt feeders to the city's distribution system are also being provided. At the Rotterdam substation, the company's main transmission center, 3 miles west of Schenectady, additions are being made to the switching structure to provide for another 110,000-volt line. At Amsterdam an additional transformer is being provided at the Church Street substation. At Gloversville and Johnstown substations are being rebuilt. At Canajoharie additions are being made to the substations to provide terminal facilities for a new 22,000-volt line. In the Glens Falls area the construction program provides for additions to the company's large switching structure at Spier Falls to provide a terminal for the new 110,000-volt line running from this point to Whitehall.

The company is also engaged in an extensive program of rural-line extension. More than 100 miles of line are being built this year, at a cost of about $200,000, which will make electric service available to hundreds of farms and rural customers.

Leaders to Speak in Maine

Prominent officials of the N.E.L.A. will head the speakers at the annual convention of the New England Section of the association, Sept. 24-27, at South Poland, Me. Monday evening a pageant of light will be staged by the women's committee of Vermont, after which President F. D. Gordon will make his address, followed by committee reports. Tuesday morning a joint commercial and women's session will be held, with reports of committees and addresses by C. E. Greenwood, commercial director N.E.L.A.; Miss Sara Harris, Utica Gas & Electric Company, and Miss Alice M. Baker, chairman women's committee, New England. A public relations session will occupy the evening, with addresses by J. F. Owens, national chairman, and John B. Reynolds, Middle West Utilities Company.

Wednesday morning two parallel sessions will be held by the Accounting Section and women's committee, and on Thursday morning an engineering session, when the speakers will include E. C. Stone, national chairman, and Major H. S. Bennion, director of engineering. W. W. Eberhardt and C. B. Hawkins of the Alabama Power Company will speak on interconnection problems.

Purchases and Mergers

Renewed reports that the Pennsylvania Water & Power Company and the Consolidated Gas, Electric Light & Power Company of Baltimore were to be merged with the United Gas Improvement Company were emphatically denied this week by J. E. Aldred, chairman of the board of directors of both the Pennsylvania and Baltimore companies.

The Colonial Utilities Corporation has been organized by Glidden, Morris & Company, New York, to acquire sixteen public utility properties in Connecticut, New Jersey, New Hampshire, Vermont and Maine, to supply without competition electric light and power, water, artificial gas and telephone service through organizations heretofore controlled and managed by local interests. The new company will supply electric light and power to Chester, Vt., and surrounding towns.

A petition was filed this week with the Indiana Public Service Commission seeking approval of the proposed consolidation of the Central Indiana Power Company's group of electric light and power properties with the Terre Haute, Indianapolis & Eastern Traction Company group.

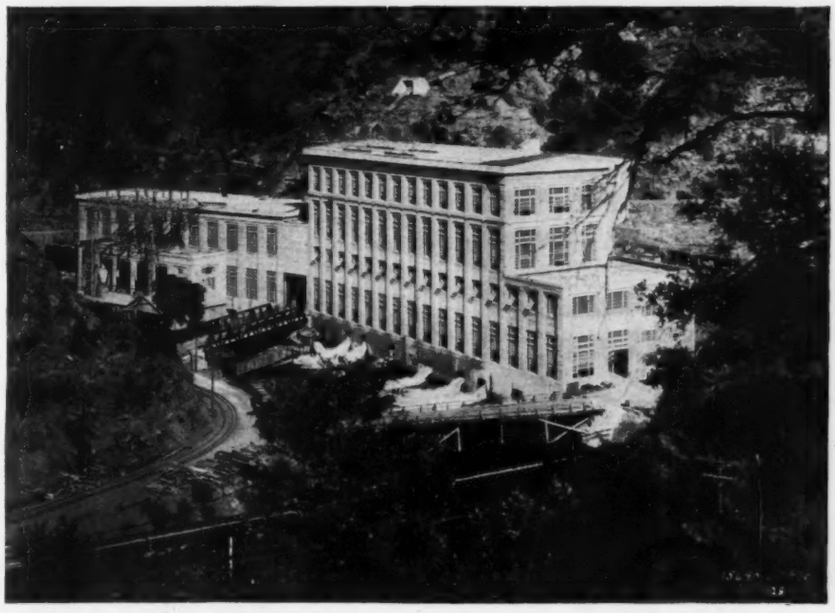
The Central Illinois Public Service Company has obtained approval of the Illinois Commerce Commission for purchase of the West Point (Iowa) Light & Power Company, owned by W. G. Zinn, who has operated a distribution system, served by the Keokuk hydro-electric plant, with a wide rural distribution.

The Western Public Service Company has purchased from the village of Rulo, Neb., the distributing plant to which it has been supplying energy wholesale, and has also purchased the plant at Lewellen from private owners and will close it down, serving the place from a transmission line out of Ogallala.

An offer of $75,000 for the municipal electric light and power plant at Timpson, Tex., has been made by Knox Lee of Marshall, general manager of the Southwestern Gas & Electric Company, an Insull subsidiary, according to Mayor J. D. Hairston. The offer was refused. The plant cost the city $30,000.

The Vernonia (Ore.) Light & Power Company, which has been in financial difficulties for the past two years, has been sold by the sheriff to D. O. Hood, chairman of a committee of bondholders, and the reorganization of the company will be undertaken at once. The new owners will change its name to the Columbia Light & Power Company.

Power House No. 2A on Big Creek in Operation



WITH a static head of 2,419 ft.—declared to be higher than that of any other hydro-electric plant of equal capacity in the United States—power house No. 2A of the Southern California Edison Company's Big Creek-San Joaquin River project was placed in operation on Aug. 15. This plant is immediately adjacent to plant No. 2 of this project (on the right in the picture) and has a capacity of 112,000 hp. The five plants of the Big Creek-San Joaquin River series now have a capacity of 457,700 hp. The penstock is 6,850 ft. long and 9 ft. in diameter at the top of the grade. The generator equipment in the power house consists of two 56,000-hp. units. Two 150-ton cranes make possible the handling of the two large units, each of which weighs 300 tons.

Power house No. 1 has a capacity of 88,500 hp. Both of the No. 2 plants are controlled from the switchboard in the older plant. Water to drive the generators in power house No. 2 comes from power house No. 1 and runs down through a tunnel to the head of the penstock. Water for power house No. 2A comes from Shaver Lake.

Energy is developed at 11,000 volts and transformed to 220,000 volts before being transmitted to central and southern California. Three 220,000-volt lines now connect the hydro-electric plants in the High Sierra with the 420,000 hp. of steam generating capacity at the Long Beach steam plant of the company.

Good Wyoming Meeting

Casper Convention of Utilities Association Draws Representatives from More than Two-thirds of the Companies in the State

SEVENTY per cent of the utility companies in Wyoming were represented at the annual convention of the Wyoming Utilities Association, held in the auditorium of the Mountain States Power Company at Casper on Aug. 17 and 18. Nearly every delegate participated in one or more of the discussions, and the meeting was declared the most successful in the association's history.

The convention got under way with a spirited talk by Guy W. Faller, vice-president of the Public Service Company of Colorado, Denver. The speaker took the ground that "socialism and communism have become firmly intrenched for a battle against the public utility industry and business in general. The public utilities of the nation," he said, "are, in fact, shock troops which are protecting every line of business and industry. Other businesses and industries may not realize that their battle for existence under the provisions of the Constitution of the United States is being fought for them by the utilities. If the utilities' front line happens to cave under the determined onslaught of those opposed to private enterprise, other lines of business will be obliged to take up the fight as never before."

The value of public utility conventions was stressed by H. L. Williams, Utah Power & Light Company, Evanston, Wyo., who remarked that "conventions such as this are merely trading places for utility ideas."

George E. Lewis, executive manager of the Rocky Mountain Committee on Public Utility Information, told the convention that much good to the utility industry has grown out of the Federal Trade Commission's inquiry. "It really required such action as that taken by the Federal Trade Commission," Mr. Lewis asserted, "to establish convincingly how well the public utilities really stand with their customers and the people generally. We have never possessed a rule by which we could measure the results of good-will advertising, talks by our employees and various other contacts which happened to be part of our public relations activities. It was naturally to be expected that the inflammatory articles published by some of the papers of the nation would exercise the people considerably. No such results ensued, however. The people have not become exercised."

Legal aspects of public utility liability were canvassed by two attorneys, G. R. Hagens of Casper and Wilfred O'Leary of Cheyenne. Uniformity in reporting valuations of telephone, gas and electric utility properties was discussed by J. G. Keegan, Cheyenne Light, Fuel & Power Company; C. L. Titus, Mountain States Telephone & Telegraph Company, Cheyenne, and J. H. Jacobbucci, Utah Power & Light Company, Green River. Rufus Gentry, Public Service Company of Colorado, talked on "The Work of the Advisory Council, a Part of Our Public Relations Activity."

"A Utility Man's Daily Dozen," a general discussion of utility practices affecting public relations, was led by W. D. Johnston, Mountain States Power Company, Casper; John R. Loiseau, Public Service Company of Colorado, Denver, and Thomas W. Hughes, Rawlings (Wyo.) Electric Light & Fuel Company. James J. Withrow, Sheridan County Electric Company, Sheridan, and Frank Jamison, Public Service Company of Colorado, were the chief speakers on public utility advertising.

The banquet took place on Friday evening, together with a "safety first" demonstration, and on Saturday "Utility Operation Without Accidents" was taken up, M. H. Soule, Western Public Service Company, Laramie, representing the light and power end, as did L. W. Edwards, Mountain States Power Company, Casper, and H. L. Williams, Utah Power & Light Company, Evanston, in a succeeding discussion on "Finding New Sources of Revenue."

These officers were elected: President, W. D. Johnston, manager Mountain States Power Company; first vice-president, H. L. Williams, Utah Light & Power Company, Evanston; second vice-president, H. E. Morgan, Northwestern Power Company, Thermopolis; third vice-president, George Oliver, Mountain States Power Company, Riverton; fourth vice-president, Barry Evans, Mountain States Telephone & Telegraph Company, Thermopolis.

"Electrical World's" London Letter

The Conference Season—Coming Discussion on Fuel Problems—A "Czar" for the Electrical Industry?—Intersectional Relationships—Rural Electrification

By Bernard C. Holding
Editor of *The Electrician*

London, August 15.

SINCE I last wrote you the British electrical industry has successfully passed through its "summer conference and outing season" and is now recuperating at various seaside resorts. Slow to acquire the conference habit, we are now becoming confirmed conference attenders, the conferences of the Incorporated Municipal Electrical Association and of the Electrical Contractors' Association attracting bigger gatherings than ever. In our present state of conference development, the maximum of social intercourse between delegates representing sectional interests is encouraged, and on this score alone the meetings are considered to be worth while. On the purely business side, however, nobody seems yet to have discovered how to get more than one paper discussed in any one morning or afternoon session. If two papers are put on, one fails to attract discussion, while if the discussion of two related papers is merged into one, speakers tend to deal principally with points arising from the last paper to be read. In the fullness of time, no doubt, we shall make our business sessions more businesslike, though it appears to some that this will not be until the overlapping and duplication and wasted time which sectional conferences entail are eliminated by means of one big electrical conference of about a week's duration, at which all matters of general industrial and trade interest will be discussed by all sections.

Lest it should be thought that we cannot organize business conferences in this country, it may be pointed out that the forthcoming fuel conference, organized under the auspices of the World Power Conference, and due to be held in London from Sept. 24 to Oct. 6, will include papers presented by fuel organizations in all the leading countries of the world. In fact, the extent of national and international participation will easily place the conference in the position of being the largest and most representative conference on fuel problems ever held. The program is divided into 22 sections, before which a total number of 167 papers are to be presented.

The idea of centralization is spreading apace, and at the conference of the Electrical Contractors' Association the director of a well-known electrical manufacturing firm had the temerity to suggest that the British electrical industry needs an electrical "czar" to guide it toward saner and more closely co-ordinated methods of trading. The suggestion has naturally met with a good deal of opposition, but, on the other hand, many supporters, and though the proposal is not likely to be carried out in its original form, it has at least given rise to a growing body of opinion in favor of so altering the organization and personnel of the British Electrical Development Association that it will be able to function through existing sectional trade associations as the supreme electrical body governing trading conditions, sectional relationships, prices and other matters of mutual interest to the industry, in addition to the purely educative and propaganda work which it now undertakes. It may require time to bring about this change, but there seems little doubt that it will take place eventually.

Those overenthusiastic supporters of the electricity (supply) act of 1926 who have so long persisted in believing, and in trying to get others to believe, that the act would assist British agriculturists by making available to the remotest farms a cheap supply of electricity must revise their views in the light of facts revealed in a government report issued by a "con-

ference on electricity supply in rural areas." This conference, after investigating rural electrification questions for some six months, clearly states that for economic reasons rural electrification cannot be proceeded with to the extent of placing a supply of electricity at the service of every inhabitant of farm and other premises throughout rural Britain, and adds that there is no doubt that the prospects in the sparsest and most remote areas are of such a low order as to preclude, or at any rate delay, for many years to come the establishment of a public supply on a remunerative basis, even under the most favorable conditions of capital expenditure on rural distribution. On the other hand, in certain rural areas where supply powers already exist, and where there is a suitable density of population, the conference expects a potential demand growing to the order of 230,000,000 kw.-hr. a year in the course of, say, the next ten years.

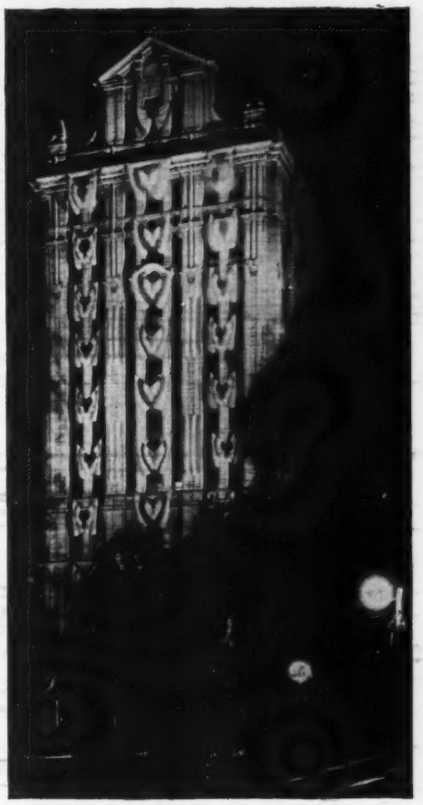
Second Bituminous Coal Conference in November

Twelve major topics for discussion at the second international conference on bituminous coal, to be held under the auspices of the Carnegie Institute of Technology, Pittsburgh, Nov. 19-24, are tentatively announced by Dr. Thomas S. Baker, president of the institution and chairman of the congress. About one hundred engineers and scientists, representing fifteen nations, have already tentatively accepted invitations to speak or to send papers to the congress, and the number of speakers and delegates is growing daily. About 60 per cent of the papers will be delivered by representatives of countries other than the United States and Canada. Delegates will attend from France, Germany, Great Britain, Italy, Russia, Austria, Belgium, Denmark, Poland, Japan, Czechoslovakia, Norway, Spain, Rumania, Jugoslavia, Bulgaria and Chile.

Although the second international conference will be similar in purpose to the first congress, held in 1926, preliminary plans for this year's meeting show that its scope will be considerably enlarged and the program will be more important and more international in character. The discussion of fixed nitrogen is one of the topics which will receive close attention. The liquefaction of coal, which was one of the principal subjects of discussion at the first meeting, will again occupy a prominent place. Low-temperature distillation will be treated by representatives of at least a half dozen countries. High-temperature distillation, power from coal, coal tars and oils, complete gasification of coal, origin of coal, coal washing, pulverized coal and catalysts are other topics that will be considered.

Addresses not yet classified under these headings will be given, it is expected, by F. S. Sinnatt, England; Raymond Berr, France; P. E. Raaschou, Denmark; John Hays Hammond, Howard N. Eavenson, E. E. Slosson, Dr. Arthur D. Little, A. C. Fieldner and Dr. H. C. Parmelee, United States.

Floodlighting at Albany for Governor's Notification



ONE of the most elaborate temporary floodlighting displays ever attempted on a political occasion was installed by the New York Power & Light Corporation at Albany for use in connection with the speech of acceptance of the Democratic presidential nomination by Governor Smith. The work was carried out under plans prepared by H. S. Beagle, director of lighting service in the commercial department, and required the services of two gangs three working days to install.

The New York Telephone Building (shown above) was flooded, affording a pillar of light to the right of the Capitol. For this display 32 500-watt and four 1,000-watt projectors were used, while the center front of the Capitol building itself was floodlighted by eleven 500-watt projectors. Augmenting this array two 1,500-watt projectors were installed on the top of the Ten Eyck Hotel, throwing their light on the top of the telephone building. The power required for the floodlighting was drawn from different circuits surrounding the Capitol, fed underground to the New York Telephone Building, and from there distributing cables were carried.

There is a possibility that the New York Telephone Company may continue the floodlighting of its building permanently. The actual lighting cost is only 40 cents per hour.

Puget Sound Company Denies Subsidy of League

That the Voters' Information League, a supposedly non-partisan group of taxpayers organized in the public interest, has been subsidized to the extent of $150,000 by the Puget Sound Power & Light Company is charged in a public statement by J. D. Ross, superintendent of the Seattle city light department. He said that he based his allegation upon a copy of the minutes of the public policy committee of the National Electric Light Association on Feb. 16.

A. W. Leonard, president of the Puget Sound Power & Light Company, admitted that his company was contributing to an investigation of the municipal light system, but denied that the subscription was anything like $150,000. He pointed out that the company had publicly announced willingness to contribute to such an inquiry months ago if it should be conducted by an impartial group that had weight in the community. Mr. Leonard refused to reveal the exact amount of the company's contributions, saying they were no more than its share as a heavy taxpayer and that the company in no way controlled the league.

Potomac Electric Power Rates Await Annual Cut

Another reduction in electric light rates, effective Jan. 1, 1929, has just been predicted at the offices of the Public Utilities Commission of the District of Columbia. The reductions have become annual affairs under the consent decree whereby the Potomac Electric Power Company devotes half of its profits over 7½ per cent on valuation to rate reduction.

Tabulation for six months showed that up to July 1 the company earned $351,747 more than it did in the corresponding half of last year. Last year the company earned more than 7½ per cent and rates were reduced, the initial rate for residential lighting being lowered to 5.9 cents per kilowatt-hour. Accountants of the commission reckoned from the first half year's profits that the figures for the entire year might show an excess of $750,000 over 7½ per cent. This might bring the rate down to 5.2 cents.

City Ownership Men Differ on Swing-Johnson Bill

Among the well-known exponents of municipal ownership of utilities who spoke at a meeting of the Public Ownership League of America held at Seattle a few weeks ago under the chairmanship of Carl D. Thompson of Chicago were Willis J. Spaulding of Springfield, Ill., president of the league; Superintendent J. D. Ross of the Seattle city plant; Superintendent Llewellyn Evans of Tacoma, Wash.; Homer T. Bone of the last-named city and J. W. McArthur of Eugene, Ore. Senator Dill of Washington discussed development of power

by the national government and averred that the most powerful lobby in history diverted the investigation of the power business from the Senate to the Federal Trade Commission.

In general, delegates who reported on the operations of the municipal plants they represented pointed to lowered rates and large savings to customers, though a few admitted that they had no such records to present. The alleged evil machinations of the "power trust" were vigorously denounced. A resolution indorsing the Swing-Johnson bill and urging an early and favorable consideration of it by the next Congress was passed over the protest of a delegate from Arizona, after a heated debate.

Briefer News

SIOUX CITY ADDS A THIRD 30,000-KW. UNIT.—At a cost of $760,000 expended for a third power unit and its auxiliaries and for additions to the building, the Big Sioux power house of the Sioux City Gas & Electric Company at North Riverside, Iowa, has been increased in capacity by 50 per cent. This unit, rated at 30,000 kw., was placed in operation on Aug. 15.

DEFIANCE, OHIO, DIVIDED OVER MUNICIPAL PLANT PROJECT.—Two ordinances intended to promote the construction of a municipal light plant at Defiance, Ohio, have been vetoed by Mayor Edward S. Bronson, who said he believed the legislation to be premature because a new referendum on the proposition is scheduled for Nov. 6. Councilmen said they would try to pass the legislation over the veto of the Mayor. Defiance is now served by the Toledo Edison Company.

KANSAS CITY AGREEMENT HELD UP.—The contract recently referred to in the ELECTRICAL WORLD as meaning harmony in the relations of the Kansas City (Mo.) Power & Light Company and the Kansas City (Kan.) municipal plant (Aug. 18, page 327) has not yet been approved by the City Commissioners of the Kansas community, and vigorous protests have been made against it by citizens who think it might lead to the eventual absorption of the city's system. Negotiations are under way for clarification or amendment of the agreement.

SASKATCHEWAN'S FIRST LONG TRANSMISSION LINE. — Construction of a transmission line from Assiniboia to Shaunavon, in Saskatchewan, Canada, a distance of 135 miles, is to be undertaken by the Dominion Electric Power Company. This is the longest system ever attempted in that province. The estimated cost is half a million dollars. All contracts have been let. The construction of the new line involves several additions to power plants and substations, and an entirely new plant is being built at Shaunavon, at an estimated cost of $120,000.

SMALL HYDRO PROJECTS IN OREGON.—Application has been filed with the Oregon State Engineer's department by the People's West Coast Hydro-Electric Corporation for authority to appropriate 15 sec.-ft. of water from Strawberry and Onion Creeks for the development of power in Grant County. E. C. Amidon of Prospect, Ore., has applied for a permit to appropriate 45 sec.-ft. of water from Red Blanket Creek for power purposes in Jackson County. T. O. and C. D. Rice of Pistol River have asked for permission to appropriate 2.0 sec.-ft. of water from Burnt Hill Creek for domestic supply and the development of electric power in Curry County.

DUQUESNE LIGHT COMPANY OPENS NEW CORAOPOLIS SUBSTATION. — The new Coraopolis substation of the Duquesne Light Company was formally opened in Pittsburgh recently. Its operation is entirely automatic, energy being received over two separately routed 22,000-volt transmission lines. The front of the building resembles a small modern public building, giving it a library effect. Novel lighting effects make it attractive at night. The rear of the building is arranged so that the side walls conceal the electrical equipment. The station may be doubled in capacity without changing the external appearance.

WEST TEXAS UTILITIES COMPANY ON THE JOB IN NEW OIL-PRODUCING TERRITORY.—Many scores of new wells will be sunk in the Yates-Trans-Pecos oil field, which is described as the greatest of recently discovered petroleum territories in Texas, and the Mid-Kansas Oil Company, one of the principal users of electric power in that area, will employ it in all the drilling and pumping operations necessary to the sinking and draining of its two hundred wells. Power will be transmitted over a 4½-mile, 12,000-volt transmission line constructed by the West Texas Utilities Company. This line will extend northeast and then south from the company's system to serve the new territory.

PROPERTY OWNER PROTESTS AGAINST POWER LINE CROSSING LAKE.—Protest has been filed with the Board of Public Utility Commissioners of New Jersey by John H. Lidgerwood, part owner of Lake Denmark, over the northern end of which the Public Service Electric & Gas Company plans to run the transmission line from Roseland, near Newark, to Siegfried, Pa., which will form part of the New Jersey-Pennsylvania interconnected 220-kv. system. Mr. Lidgerwood contends that to carry the lines across the lake will destroy its beauty, making it "unsightly and dangerous" and seriously impairing the value of the whole of the property affected. He thinks that the line "could as well be run either to the north or to the south of said lake without serious impairment of its efficiency." The regulatory body will set a date to hear the case, the petition in which was filed by H. V. Osborne, former chairman of the commission.

ONTARIO HYDRO TO GET GATINEAU POWER ON OCT. 1.—According to an announcement by A. R. Graustein, president of the International Paper Company, the first block of power to the Hydro-Electric Power Commission of Ontario from the company's new plants on the Gatineau River in the Province of Quebec will be delivered on Oct. 1. The three huge power plants which have been built are designed for a total installation of 562,000 hp., but for the time being the installation will only be 432,000 hp. At present a considerable portion of the power being developed at the Chelsea and Farmers plants is being used to operate the company's big newsprint mill at Gatineau, on the Ottawa River.

CHARLESTON (W. VA.) MEETING OF AMERICAN ELECTROCHEMICAL SOCIETY.—A good program has been arranged for the fall meeting of the American Electrochemical Society at Charleston, W. Va., on Sept. 20-22, and many excellent papers have been contributed. Thursday morning will be devoted to a scientific and technical session at the Hotel Kanawha. The main topic of discussion will be "Chemical Reactions at 1,000 deg. C. and Above." On Friday morning there will be another scientific session. In the afternoon the members will be taken by special train to the International nickel plant near Huntington. A session on the electrodeposition of copper, chromium, nickel, tellurium and graphite will be held Saturday morning.

FULTON, N. Y., TO GET MORE POWER.—An addition of nearly 50 per cent will be made to the capacity of the hydraulic canal plant of the Fulton (N. Y.) Light, Heat & Power Company through extensions now under way. The present capacity of 1,100 hp. will be increased to 2,000 hp. by the installation of another generator, to be completed in the fall. Although three-fourths of the power developed on the Oswego River in Fulton is owned directly by manufacturing concerns, many other firms depend upon the local utility company for power, and the present consumption is far beyond its production possibilities. For several years it has leased energy from the Oswego Falls Corporation, which also has a plant on the raceway and which controls a site on the Barge Canal.

INTERSTATE PUBLIC SERVICE COMPANY WINS L. E. MYERS AWARD.—First place in the L. E. Myers award competition for Insull subsidiaries has been won by the Interstate Public Service Company of Indianapolis. For second place the Public Service Company of Northern Illinois and the Public

Service Company of Oklahoma are tied. This award is made annually to the company of the Insull group of utility properties which is considered by the prize award committee as having made the most notable contribution of the year to the development of electric light and power for the convenience of the public and benefit of the industry. It corresponds in the Insull organization to the Charles A. Coffin award, which is open to all electric companies in the United States.

NEW ELECTRICAL BUILDING AT TORONTO EXHIBITION A PROMINENT FEATURE.—The Canadian National Exhibition at Toronto was opened on Aug. 24 by the Governor-General, this being its fiftieth anniversary. The most important new feature is the Electrical and Engineering Building, just completed at a cost of $600,000. It is constructed of steel, artificial stone and red brick and architecturally is one of the most striking of the 99 permanent structures on the ground. It contains 60,000 sq.ft. of floor space. Except in the case of three exhibitors, the entire space available for electrical displays, which is 60 per cent of the total, has been taken for a period of ten years. The number of exhibits is approximately 500, including every known type of electrical appliance and every variety of machinery in common commercial use.

ARKANSAS POWER & LIGHT'S NEW SUBSTATION.—The Arkansas Power & Light Company will soon complete work on the Woodward substation near Pine Bluff, Ark., where the company has expended more than $500,000, chiefly for transformers and a new line to Little Rock. The Woodward substation is the terminal of four of the company's high-voltage lines, two from the Sterlington (La.) gas-fired plant and two from the Remmel Dam. From this station electricity will be distributed to the lines of the three major Couch companies—the Arkansas Power & Light, the Mississippi Power & Light and the Louisiana Power & Light. Nearly $500,000 had already been spent in constructing a high-voltage line to Camden and other points. The company recently agreed to construct a line to Hearndale, a new subdivision on the Sulphur Springs pike west of Pine Bluff.

MASTER-METER QUESTION PRESENTS ITSELF IN WASHINGTON. — Scores of owners of large buildings in Washington, D. C., have been notified by the Potomac Electric Power Company that they will have to cease the practice under which they have bought—some of them for many years—electricity in large quantities at low wholesale rates and have remetered it to tenants at the maximum retail schedule. Contracts have been canceled by the power company, and the landlords have been notified they will be required to sign new agreements specifying that the energy purchased is for their own use or their power will be cut off. By this means the power company seeks to put an end to what it terms rebating, which is unlawful. The new policy was announced last week by the company, following publication by the secretary of the Operative Builders' Association of a letter sent by him to the Public Utilities Commission protesting against the new form of contract.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for July 7, page 48.]

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 5-7. H. A. Buch, Telegraph Bldg., Harrisburg, Pa.

Maryland Utilities Association—Braddock Hotel, Braddock Heights, Md., Sept. 7. D. E. Kinnear, 1005 Continental Bldg., Baltimore.

Western Section, International Association of Electrical Inspectors—Cosmopolitan Hotel, Denver, Sept. 10-12. W. S. Boyd, 175 West Jackson Blvd., Chicago.

Society for Electrical Development—Annual meeting, New York, Sept. 14. J. Smieton, Jr., 420 Lexington Ave., New York.

Illuminating Engineering Society—King Edward Hotel, Toronto, Can., Sept. 17-20. L. H. Graves, 29 West 39th St., New York.

Rocky Mountain District, N.E.L.A.—Hotel Colorado, Glenwood Springs, Sept. 17-20. (With Colorado Utilities Association.) O. A. Weller, Public Service Co. of Colorado, Denver.

Empire State Gas and Electric Association—Saranac Inn, Upper Saranac, N. Y., Sept. 20-21. C. H. B. Chapin, Grand Central Terminal, New York.

American Electrochemical Society—Hotel Kanawha, Charleston, W. Va., Sept. 20-22. C. G. Fink, Columbia University, New York.

American Electric Railway Association—Cleveland, Sept. 22-28. J. W. Welsh, 292 Madison Avenue, New York.

International Committee on Illumination, Saranac Inn, Lake Saranac, N. Y.—Sept. 22-28. (See Illuminating Engineering Society.)

New England Section, N.E.L.A.—Poland Springs House, South Poland Springs, Me., Sept. 24-27. Miss O. A. Bursiel, Statler Bldg., Boston.

Great Lakes Section, N.E.L.A.—French Lick Springs, Ind., Sept. 27-29. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

American Society of Mechanical Engineers—Boston, Oct. 1-3. C. W. Rice, 29 West 39th St., New York.

Association of Edison Illuminating Companies—Chamberlin-Vanderbilt Hotel, Old Point Comfort, Va., Oct. 1 to 5. P. S. Millar, East End Ave. and 80th St., New York.

National Safety Council—Hotel Pennsylvania, New York, Oct. 2-5. W. H. Cameron, 108 East Ohio Street, Chicago.

Southern Appalachian Power Conference—Atlanta, Oct. 8-10. W. A. Nelson, Charlottesville, Va.

American Welding Society—Philadelphia, Oct. 8-13. M. M. Kelly, 33 West 39th St., New York.

Eastern Association of Electrical Inspectors—Municipal Bldg., Springfield, Mass., Oct. 10-11. R. Walker, 85 John St., New York.

Kansas Section, N.E.L.A. — Wichita, Kan., Oct. 18-19. H. Lee Jones, 401 National Reserve Bldg., Topeka.

International Association of Municipal Electricians—Hotel Montelson, New Orleans, Oct. 22-26. H. N. Lang, Box 1864, Orlando, Fla.

Public Utilities Association of West Virginia—Hotel Pritchard, Huntington, Oct. 24-25. A Bliss McCrum, 514 Charleston National Bank Bldg., Charleston.

American Institute of Electrical Engineers — Regional meeting, Atlanta, Oct. 29-31. F. L. Hutchinson, 33 West 39th St., New York.

National Electrical Manufacturers' Association—Briarcliff Lodge, Briarcliff, N. Y., Oct. 29-Nov. 1. S. N. Clarkson, 420 Lexington Ave., New York.

COST OF RURAL SERVICE IN NEBRASKA.—The Gage County Electric Company has entered the rural field in Nebraska with two additional transmission lines, one of which will be 21 miles long and serve 30 farms, the other serving eleven on a 7½-mile stretch. In each instance construction was made possible by getting one large consumer, although there are no more than two customers to the mile in either case. The company finds that it can build these lines, with transformers in place, for less than $1,000 a mile.

OSWEGO'S NEW MUNICIPAL PLANT READY.—Final inspection and recommendation of acceptance of the new municipal power plant in Oswego, N.Y., constructed by the Oswego River Power Corporation, has been made by former State Engineer Frank M. Williams, consulting engineer to the Water Service Commission. The new plant is producing more than 7,500 hp.

OPPONENT OF UTILITIES FAILS TO GET GUBERNATORIAL NOMINATION IN OHIO.—Attorney-General Edward C. Turner, who as a candidate for the Ohio gubernatorial nomination repeatedly charged that there was a joint lobby of utility interests and dry forces in that state, was defeated at the recent primary. Mr. Turner ran a poor third and was defeated by M. Y. Cooper, the successful candidate, by almost three to one. In his campaign Mr. Turner asked for the repeal of the present Pence law and the remaking of the State Utilities Commission.

LOUISVILLE COMMUNITY CLUB EXPOSES UTILITY PROFITS.—A community organization in Louisville calling itself the Portland Civic Club, which specializes in attacking utility companies, recently hung a banner in the streets demanding a 50 per cent reduction in the price of electricity and declaring that the Louisville Gas & Electric Company made more than 50 per cent profit last year as disclosed by "Poor's Manual of Public Utilities." Newspaper publicity and the interest of citizens resulted, but inexpertness as financiers was brought home to the club's spokesmen when General Manager T. Bert Wilson of the company pointed out that the figures quoted did not include dividends on stock, interest on bonds or depreciation, and that earnings on investment, approximately 7 per cent, could be found in the manual by any one who knew where to look for them.

NEW YORK POWER & LIGHT STARTS LINE THROUGH MOUNTAINOUS COUNTRY.—Work has been pushed by the New York Power & Light Corporation on a steel-tower transmission line from Queensbury, east of Glens Falls, to Whitehall. This 21-mile line will carry two circuits, one to operate at 33,000 volts, reinforcing the present lines supplying power to Fort Ann, Whitehall and Granville, and a second to operate at 110,000 volts, making possible future connection with companies oper-

ating in Vermont, as well as delivery of substantial amounts of power north to Ticonderoga and to the company properties at Crown Point and Port Henry. The building of this line through mountain country presents difficult construction problems since the right-of-way is inaccessible to ordinary vehicles. The line is expected to be finished in September.

UNIQUE CLUBHOUSE FOR CINCINNATI COMPANY EMPLOYEES. — A log cabin constructed entirely of old electric light poles on a fifteen-acre site in Hartwell, a suburb of Cincinnati, is to be dedicated Sept. 8 by the Union Gas & Electric Company and affiliated Columbia system companies. The cabin, which will serve as a clubhouse for the employees of these organizations, is adjoined by an athletic park containing two baseball diamonds, three tennis courts, three traps for clay-pigeon shooting and pistol and rifle ranges.

COMMERCIAL ELECTRIC COOKING COURSES THIS MONTH. — Under the auspices of the commercial electric cooking committee of the N.E.L.A. two instruction courses in the promotion and application of commercial electric cooking will be given in September—the first from Sept. 17 to 19 inclusive at the quarters of the Edison Electric Appliance Company, Chicago, and the second on Sept. 20 to 22 at the Mansfield (Ohio) quarters of the Westinghouse Electric & Manufacturing Company. These courses are for commercial managers, power salesmen and commercial cooking specialists and include instruction on many points, among them load characteristics, revenue per dollar of investment, cost of securing business, market analysis, sales plan for central stations and equipment.

ARC WELDING PERMITS RECONSTRUCTION OF CLEVELAND BUILDING WITHOUT DISTURBING TENANTS. — Extensive alterations have just been completed on the Rose Building, a ten-story structure in Cleveland, including the addition of four stories to a part originally only six stories in height, without disturbance to the tenants, largely physicians and dentists. This feat was accomplished by the employment of arc welding. In this way much wrecking was eliminated, and the silent nature of the process prevented disturbance from noise. Thousands of dollars in rentals were saved to the owners of the building. The welding machines used were supplied by the Lincoln Electric Company.

GENERAL ELECTRIC COMPANY'S EDUCATIONAL ENTERPRISES.—Training college graduates in the problems of rural electrification is to be continued this year by the General Electric Company, which has announced the enrollment of its second class in this subject, comprising twelve men and an instructor. Eleven states in the South, the Middle West, the mid-Atlantic district and New England are represented. The course comprises eight weeks at the Schenectady works, seven weeks among other General Electric factories and two weeks of classroom work. In furtherance of another and long-established endeavor of the company 222 student engineers have been added to the test course at the Schenectady works of the company since May. They represent nearly an equal number of colleges from California to Maine. Graduates of engineering or technical schools in South and Central America, Australia and Europe are also numbered among them.

Recent Court Decisions

COMPANY MUST NOT DISCONTINUE SERVICE TO ONE PROPERTY BECAUSE CUSTOMER OWES BILL FOR ANOTHER.—In the New York Supreme Court a decision has been handed down in Utica Gas & Electric Company vs. Clark holding that the company cannot legally shut off light from one house because the owner failed to pay the bill for another property owned by him. An appeal to the Appellate Division will be taken, it is understood.

CONTRIBUTORY NEGLIGENCE AS A MATTER OF LAW.—Sustaining a directed verdict for the defendant in Murphy vs. Iowa Electric Company, a suit for damages because of death from electric shock, the Supreme Court of Iowa said that where the facts are clear and undisputed and the contributory negligence apparent to any fair-minded man the trial court does right to direct a finding in the defendant's favor. It held the case under review to be of this kind since the victim of the accident met death when he attempted to remove a telephone wire from the path of his team by throwing it over a spike in the power company's pole and, standing on his wagon, swang it so high that it came into contact with a transmission line whose distance above a newly graded road was variously put at from 10 ft. to 17 ft. (220 N.W. 360.)*

NEGLIGENCE AND FORESIGHT IN RELATION TO TRANSMISSION-LINE CONSTRUCTION.—It is not necessary, said the New York Supreme Court, Appellate Division, in Grant vs. Utica Gas & Electric Company, in order to set up liability for damages because of a fatal accident, that an electric company should have foreseen particular consequences which might arise from its negligent construction of an uninsulated high-power line; the question was whether it should have anticipated, in the exercise of reasonable care, that some accident might occur. The trial judge was therefore declared in error in withdrawing from the jury the above case, in which an employee of a bleaching company while working on a pole belonging to his employer lost his life through contact with the electric company's line, which was 27½ inches higher than the pole on which the victim was at work, the electric company's line having been built subsequently to the bleaching company's service line. (229 N.Y.S. 766.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

ONE COMPANY ORDERED TO SERVE DISPUTED TERRITORY WHILE LITIGATION GOES ON.—The Illinois Commerce Commission has ordered the Illinois Power & Light Corporation to serve territory in Macoupin County, near Sawyerville, until the settlement of litigation between this company and a rival that seeks to enter the territory. The commission's order was the outcome of a complaint from residents that the dispute between the companies was depriving them of electricity.

MONTHLY PAYMENT AGREEMENT IN PURCHASE OF POWER PLANT IS EVIDENCE OF INDEBTEDNESS.—In approving the sale of the Quincy Electric Light & Power Company for $50,000, the California Railroad Commission asserted that an agreement whereby a part of the purchase price is payable upon the granting of authorization to transfer properties and the balance payable in monthly installments constitutes an evidence of indebtedness, the execution of which must be approved by the commission.

COMMISSION HAS JURISDICTION OVER CHARGES OF METER JUMPING.—The Missouri Public Service Commission has ordered the Union Electric Light & Power Company of St. Louis to restore service to a household which was cut off more than a year ago when an inspector reported he found a jumper on the meter at the premises. The commission found that this charge was not substantiated by proof. The company had sought dismissal of the complaint on the ground that the commission did not have jurisdiction. The commission held that the company in discontinuing service and refusing to restore it discriminated against the complainants.

ELECTRIC CUSTOMERS CANNOT RIGHTLY BE ASSESSED PART OF COST OF SUPPLYING STEAM HEAT TO OTHERS.—A complaint made by the Wayne Public Safety Association against the Wayne Steam Heat Company was found by the Pennsylvania Public Service Commission to have its origin in the discontinuance of steam-heating service by the former Wayne Electric Light & Steam Heat Company, the Counties Gas & Electric Company, which owns the plant, now confining it to steam-heat service only. The commission said: "The question before the commission is therefore whether, by reason of the fact that formerly electrical energy and steam heat were produced jointly and are now produced through separate plants at a reduced cost to the electric service and an increased cost to the steam-heat service, the electric service should be required to bear the increased costs of the steam-heat service made necessary by the change. Prior to this change the utility was forced to decide whether it would continue to provide its local service in the old manner, benefiting one group of consumers by maintaining existing conditions, or make the change tending to greater economy in the one service but thereby increasing the cost of rendering the other. Whichever decision it might make, one group of consumers would feel aggrieved. In the light of all the facts before the commission, it cannot be found that the utility's decision was unreasonable, or that the consumers of the electric service could reasonably or legally be required to bear a part of the cost of serving steam-heat patrons."

News About Men of the Industry

W. A. Durgin Field Secretary of Utilities Commission

W. A. Durgin, director of public relations of the Commonwealth Edison Company, while retaining this position, will take over Sept. 1 the duties of field secretary of the Utilities Research Commission, which is jointly supported by the Commonwealth Edison Company, the Peoples Gas Company, the Public Service Company of Northern Illinois, the Middle West Utilities Company, the Chicago Rapid Transit Company, the Northern Indiana Public Service Company and the Chicago & North Shore Railway. It is the function of the commission to keep itself informed on all research affecting the operation of public utilities and the furtherance of use of their services, to consider and discover suggestions for research and to initiate and finance investigations of utility problems. As field secretary of the commission Mr. Durgin's duties will be to acquaint himself with research in progress in government bureaus, universities and other places, to report on research progress and to act as a liaison between the commission and the field.

SIR ALEXANDER MACKENZIE has resigned as president of the Brazilian Traction, Light & Power Company, Ltd., because of ill health and has been succeeded by Miller Lash, K. C. Sir Alexander will remain as a director and continue to act in a consulting capacity.

G. W. FORD, who formerly acted as manager of the Toledo (Ore.) electric utility, a Peoples West Coast Hydro-Electric Corporation holding, has been appointed manager for the Vernonia (Ore.) Light & Power Company, about to be reorganized as the Columbia Light & Power Company under the control of a bondholders' committee.

HON. FLEMING B. MCCURDY was appointed president of the Trinidad Electric Company at a recent meeting of the board of directors to suceed the Hon. W. B. Ross. J. H. Winfield and W. H. Couvert were appointed to the board, succeeding F. W. Teale and the Hon. W. B. Ross. Mr. McCurdy established the financial house of F. B. McCurdy & Company, with head office at Halifax in 1901. He is a past-president of the Halifax Board of Trade and has been extremely active in Canadian politics for a number of years.

H. EDMUND MACHOLD, who has been prominently identified with the Carlisle interests in recent years, has resigned as president and director of the Northeastern Power Corporation and all its subsidiaries and as a director of the Mohawk-Hudson Power Corporation to become chairman of the Republican state committee. Mr. Machold's decision to devote himself entirely to political campaign management followed his unanimous election to the chairmanship left vacant by the recent death of George K. Morris. He was formerly Speaker of the New York State Assembly and it was under his leadership as such that the water-power and traction program of former Governor Miller was put through the State Legislature.

M. E. Sampsell New Head of Commercial National Section

Marshall E. Sampsell, who was appointed chairman of the Commercial National Section of the National Electric Light Association, as announced in the Aug. 11 issue of the ELECTRICAL

M. E. Sampsell

WORLD, has been prominently identified with the public utility industry in the Middle West for a number of years. A native of Marshall, Tex., Mr. Sampsell was graduated from the University of Chicago in 1896 and from the Chicago College of Law in 1899. He was clerk of the United States Circuit Court for the Northern District of Illinois from 1902 to 1907. He began his public utility career in 1903 as receiver for the Chicago Union Traction Company and other affiliated street railway companies. During the several years of this receivership Mr. Sampsell took an active part in the street railway negotiations of that period which resulted in the adoption of the famous Chicago traction settlement ordinances of 1907.

Mr. Sampsell is a director of the Middle West Utilities Company and president of the Central Illinois Public Service Company and Wisconsin Power & Light Company, two of its largest subsidiary companies. He has served as president of the Illinois Electric Railway Association and of the Great Lakes Geographic Division of the National Electric Light Association and during last year was a vice-chairman of the Public Relations National Section.

R. S. Twitchell Made Secretary of Boston Engineers

Richard S. Twitchell has been elected executive secretary of the Affiliated Technical Societies of Boston, succeeding Prof. John B. Babcock of the Massachusetts Institute of Technology, who recently resigned on account of the pressure of other work after several years of able service in the development of this organization of engineering societies.

Mr. Twitchell is well known in New England electrical circles. He was educated at Stevens Institute and Cornell University, then taught physics for four years, after which he was with the Western Electric Company for seven years in its New York office as office manager, general assistant to the manager of the contracting department and in general sales engineering work. From 1910 to the fall of 1927 he was with the Westinghouse Electric & Manufacturing Company with headquarters at Boston, specializing in power apparatus sales and engineering in both steam and electrical fields. For the past eight years he was Westinghouse representative on the electrical apparatus committee of the New England Division, N.E.L.A., and is now engaged in steam and electrical consulting engineering with offices in Boston.

R. S. RODENHUIS, manager of the Sparta district of the Northern States Power Company, has been appointed manager of the Minot division, and C. B. Ayars, superintendent of the Sparta district, has been appointed manager of the Sparta district.

HERMAN RUSSELL, vice-president Rochester Gas & Electric Corporation, also president of the Chamber of Commerce of Rochester, has been named chairman of the committee of five appointed by City Manager Stephen B. Story, to be known as the Council on City Plan. The object of this committee is the development of a city plan, including a civic center.

GENERAL JAMES G. HARBORD, president of the Radio Corporation of America, has been granted a leave of absence from Sept. 1 to Nov. 6 by the directors of the corporation in order that he may devote personal attention to his work as chairman of the committee to raise funds for the Republican campaign in the metropolitan district, including New York City, Long Island and Westchester County. Owen D. Young, chairman of the board of directors of the Radio Corporation, announced that there would be no change in the management or policies of the corporation during the two months' leave of absence granted to General Harbord.

W. H. Grove Joins Foshay Company

William H. Grove, well known in public utility circles, has joined the engineering staff of the W. B. Foshay Company as assistant to the president of the Public Utilities Consolidated Corporation. Prior to joining the Foshay Company Mr. Grove was director, president and treasurer of the Century Engineering Corporation, Newark, N. J. Formerly he was president of the Grove Electric Corporation, New York City, and from 1905 to 1925 he held various responsible positions, from engineer with the Philadelphia Rapid Transit Company to public utility specialist and consulting engineer with Frazier Jelke & Company, New York. With the latter company he specialized in utility statistics, reports, analyses and management. He was at one time in the engineering department of the J. G. Brill Company of Philadelphia, with William Cramp & Sons in Philadelphia in the hydro-electric department, and transmission engineer with the Cleveland Electric Illuminating Company.

For many years he has been a member of the National Electric Light Association, having served as chairman of the membership committee of the association, on the executive committee, educational committee and the papers committee. He is also a member of the Electrical League, Cleveland; the American Electric Railway Association and the Cleveland Safety Council.

PHILIP G. GOSSLER, president of the Columbia Gas & Electric Corporation, returned from abroad Aug. 28 aboard the White Star liner *Olympic* after a two months' visit in Europe.

CLARENCE B. SLACK, for the past twelve years associated with the Northern New York Utilities, Inc., in various capacities from meter reader to store manager at Carthage, has been made manager of the Watertown division. MARTIN J. RYAN of Watertown has been made assistant sales manager of the Northern New York Utilities, Inc. He has been with the company about a year, serving as sales supervisor.

A. E. HERZBERG, manager of the transformer sales division of the Wagner Electric Corporation, has been promoted from the grade of major of the United States Army Reserve to the grade of lieutenant-colonel. Colonel Herzberg's promotion is the latest of a series of continuous and rapid promotions, starting with his original commission as first lieutenant just before our country entered the World War. His entire business career has been in the electrical industry. His early activities were in the fields of telephony and railroading, but by 1910 he was devoting practically his entire time to building central stations and laying out distribution systems, and in addition electrically equipping large industrial plants. In 1912 he varied his field of experience still more by entering the sales end of the electrical industry, which gradually led up to his joining the Wagner Electric Corporation as manager of transformer sales division in 1924.

Eustace C. Soares Returns to Consulting Engineering Field

Eustace C. Soares, for the past five years manufacturing and markets editor of the ELECTRICAL WORLD, resigned Sept. 1 to become an officer of the R. B. Engineering Corporation, consulting engineers of New York. Prior to joining the staff of the ELECTRICAL WORLD Mr. Soares for more than four years was connected with Ophuls & Hill, Inc., consulting engineers, of New York, as electrical engineer in charge of all electrical operations.

His technical education was obtained at the American School of Correspondence and at Cooper Union, New York. He holds a license as professional engineer in the state of New

E. C. Soares

York. He has been at different times connected with the Westchester Lighting Company, the Brooklyn Edison Company and the United Electric Light & Power Company and previous to his association with Ophuls & Hill he was identified for four years with the Crocker-Wheeler Electric Manufacturing Company in its testing, maintenance and repair departments. Before joining the staff of the ELECTRICAL WORLD Mr. Soares was a frequent contributor to the ELECTRICAL WORLD and *Industrial Engineer*. Mr. Soares has been a very capable member of the editorial staff and carries with him best wishes for success in his new business.

E. H. GERBERDING of Pittsburgh has been promoted to the position of assistant treasurer of the Westinghouse Electric & Manufacturing Company. Mr. Gerberding began work in the company's treasury department 28 years ago and has been continuously employed in the same department since that time.

JOSEPH F. FRESE has been elected vice-president of the Monitor Controller Company and assistant chief engineer, with headquarters at the home office in Baltimore. Mr. Frese has been connected with the Monitor interests for about 28 years, having grown up with the company. Some fifteen years ago he opened up the New York office and developed the trade in that district to its present proportions. He possessed a natural inclination and ability toward the practical application of control apparatus which will now be of particular advantage to the entire selling organization.

CHARLES M. YALE, superintendent of distribution of the Hartford (Conn.) Electric Light Company, has been made a member of the street commission of Hartford by appointment from Mayor Batterson.

Obituary

RICHARD T. DANA, consulting engineer of New York, died Aug. 26 at his summer home in East Islip, Long Island, after a long illness. He was about 53 years of age. Mr. Dana received his technical education at Yale University, having been graduated from the Sheffield Scientific School in 1896. From 1902 until the time of his death he had conducted a private consulting engineering practice. He was the author of several engineering books and was co-author of "Mechanical and Electrical Cost Data," in addition to contributing numerous papers to the technical press.

JOHN G. PERTSCH, JR., professor of electrical engineering at Cornell University since 1923, was drowned Aug. 23 in an attempt to rescue a woman as she sank in Cayuga Lake. Professor Pertsch received his technical training at the Baltimore Polytechnic Institute and Cornell University. Practically his entire career had been devoted to academic work at Cornell, which institution he joined in 1909 as assistant professor of electrical engineering. In the summer Professor Pertsch supplemented his teaching with practical engineering work with the General Electric Company and with the Westinghouse Electric & Manufacturing Company. He was a member of the American Institute of Electrical Engineers and of the Society for the Promotion of Engineering Education.

THEODORE KOELKER, 56 years old, superintendent of the Carlyle, Ill., electric light plant, was electrocuted Aug. 20 while changing wires. He had climbed to the top of a pole and in cutting a wire one of the ends came in contact with his body. Death was instantaneous.

DR. CHARLES CHREE, a distinguished authority on terrestrial magnetism and atmospheric electricity, died at Worthing, England, Aug. 12. He was for 32 years superintendent of Kew Observatory. Dr. Chree, who was 68 years of age, was the author of the articles on "Atmospheric Electricity," "Earth Currents," and "Terrestrial Magnetism" in the eleventh edition of the Encyclopædia Britannica.

Financial and Statistical News

Calls for a Dictator

In "Atlantic Monthly" M. R. Scharff Finds Fault with Public Utility Management, Especially as Regards Holding-Company Profits from Fees

IN THE *Atlantic Monthly* for September Maurice R. Scharff, formerly chief engineer for the Pittsburgh branch of the Ryllesby Engineering & Management Corporation, discusses "The Public and Their Utilities: Finance, Engineering and Management." Mr. Scharff pays his attention especially to holding companies. Acknowledging their "genuine accomplishments in extending and improving public utility service," he declares that "serious abuses have established themselves."

Following a hypothetical holding company through a series of supposititious transactions of a devious sort to final disaster, Mr. Scharff then takes up such elements in the question as high fees to operating subsidiaries for management and engineering expenses and the other profits taken from the public utility industry through exercise of voting control, the alleged impossibility of ascertaining from the reports of holding companies the proportion of earnings received from stocks of operating subsidiaries and the proportion from fees charged these subsidiaries, "the lack of any established standards for reasonable charges, the extreme variation in such charges by different controlling groups and the obvious unreasonableness of some of the charges that are made."

AUTOCRATIC LEADERSHIP SUGGESTED

Because of anticipated public condemnation of practices that the Federal Trade Commission is sure to disclose, the duty of the public utility industry, Mr. Scharff holds, is clear. It should "at once add to its already extensive organization a dictatorship in the integrity and independence of which the public can have absolute confidence." Under the leadership of this dictator "the industry should develop standards, in harmony with its professed ideals of public service, for reasonable charges for all kinds of service customarily rendered by one affiliated company to another. And it should exert the full influence of the leadership of the industry either to bring the practices of all member companies into harmony with such standards or else to cast out the companies refusing to conform, for the public condemnation and destruction which they deserve and will no doubt receive."

Alluding to threatened government ownership and operation, "than which no greater public calamity can be imagined," Mr. Scharff mentions three types of legislation which he thinks present themselves as possible of embodiment in state or federal statutes. Two of these types he himself condemns, but he seems inclined to favor prohibiting all profits on transactions between the public utility companies and affiliated non-utility companies. He thinks that regulation by public service commissions has suffered a "partial breakdown."

Pacific Gas & Electric to Issue Stock

The Pacific Gas & Electric Company has applied to the California Railroad Commission for authority to issue $10,000,000 of 5½ per cent first preferred stock at par $25. The proceeds will be used to reimburse the treasury for money expended for additions and betterments.

Public Service Votes Dividend on New $5 Issue

Directors of the Public Service Corporation of New Jersey voted an initial quarterly dividend of $1.25 a share on the no-par $5 cumulative preferred stock recently issued. They also declared the regular quarterly dividend of 50 cents a share on the common stock, $1.75 a share on the 7 per cent preferred, $2 a share on the 8 per cent preferred and the regular monthly dividend of 50 cents a share on the 6 per cent preferred.

Market Waits on Money Conditions

THE stock market has remained quite steady during the week with a good volume of transactions in utility securities. Despite a 7 per cent money rate last week and an 8 per cent rate early this week investors have been buying and the market has been buoyant.

Good business conditions in nearly every line of industry and splendid reports of earnings by utilities have discounted the effect of high money rates to a large extent. The future trend of the market is problematical from a speculative point of view, but good utility securities are being sold investors for a long pull. The large amount of brokers' loans outstanding and the high money rates, combined with the attitude of the Federal Reserve, make it impossible to predict the market trend for the next few weeks. Member banks of the Federal Reserve system have increased their borrowing to meet month-end requirements and financial needs in agricultural districts.

Copper and industrial stocks advanced appreciably and many electrical stocks have made good gains. Some brokers anticipate a good market for the immediate future, but others are pessimistic as to any change for some time to come.

Electric Power & Light Prospering

WIDELY separated subsidiary properties make for stability in holding company earnings and enable the parent system to maintain credit as the business tide ebbs and flows in different localities. The data in the 1927 annual report of the Electric Power & Light Corporation gives tangible evidence of the business and financial advantages of such a grouping of properties. This corporation has expanded rapidly in the past two or three years and now serves 634 communities in ten different states of the South and West. Many of the subsidiaries are old-established operations, but others are new transmission companies recently organized to interconnect and consolidate many small isolated properties. Typical of these operating units formed in 1927 are the Louisiana Power & Light Company and the Mississippi Power & Light Company.

The gross earnings of all subsidiaries for 1927 amounted to $52,629,116, an increase of 6 per cent over 1926, and the net earnings were $23,705,513, an increase of 9 per cent. After all deductions the corporation earned $2.09 per share of common stock in 1927, as compared to $1.45 in 1926. During the year the subsidiaries added 157,000 kw. to their generating capacity and 1,352 miles of electric lines over 11,000 volts. All facilities were improved and extended and the increased net is due greatly to the effect of improvements in the system equipment.

An abstract of the earnings statements of the important subsidiaries shows that each made progress and had a substantial balance after all charges. It should be noted particularly that a renewal and replacement fund is set aside by each subsidiary and that the parent holding company also sets aside about the same total sum to care for renewals and replacements. This sound practice means that each property has a reserve and that the holding company also has a reserve to call upon should any individual subsidiary meet a financial emergency of any character.

The balances of the individual subsidiaries and of the parent corporation are very satisfactory. The service applied is largely electric power and light, but some railway, water and gas services are included. In the past two years some unprofitable railway properties have been disposed of and several electric properties have been purchased.

A glance at the earnings statements of subsidiaries shows that gross income has increased in varying degrees on the subsidiaries and has decreased in the

case of the Dallas Railway & Terminal Company. The Utah Power & Light Company gross has not increased greatly because business and agricultural conditions were in a slump, but a satisfactory increase in gross business was had in other large subsidiaries, such as the New Orleans Public Service Company, Arkansas Power & Light Company and Dallas Power & Light Company. The greatest expansion in service facilities is being made in Louisiana and Mississippi, where small towns are served from an extensive transmission system. Improved service and an aggressive selling campaign are doing much to improve general business in these regions.

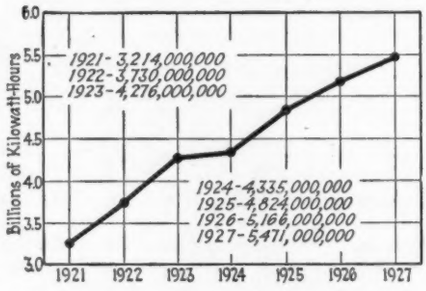
Electric Power & Light Corporation

	1927	1926
Gross earnings	$7,225,824	$5,641,311
Expenses	695,801	779,993
Net earnings	6,530,023	4,861,318
Interest and dividends	4,540,778	4,154,868
Balance after dividends, etc.	1,989,245	706,450
Renewals and replacements	4,083,384	4,070,876
Part of balances from operation of subsidiaries	1,722,253	1,869,219
Combined undistributed income	3,711,498	2,575,669
Arkansas Power & Light Company		
Gross earnings from operations	$6,412,965	$5,920,234
Operating expenses and taxes	3,380,925	3,213,413
Total income	3,228,865	2,880,771
Interest and dividends	1,801,513	1,574,916
Renewal and replacement reserve	320,706	312,814
Balance	1,106,646	993,041
Dallas Power & Light Company		
Gross earnings from operations	$4,405,844	$4,041,841
Operating expenses and taxes	2,241,358	2,007,135
Total income	2,189,340	2,039,633
Interest and dividends	950,159	864,595
Renewal and replacement reserve	442,000	670,500
Balance	797,181	504,538
Dallas Railway & Terminal Company		
Gross earnings from operations	$3,261,004	$3,454,409
Operating expenses and taxes	2,434,900	2,639,259
Total income	826,104	815,150
Interest and dividends	430,471	396,861
Renewal and replacement reserve	178,452	185,819
Balance	217,181	232,470
New Orleans Public Service, Inc.		
Gross earnings from operations	$18,442,108	$17,624,514
Operating expenses and taxes	11,426,537	11,180,993
Total income	7,287,589	6,545,937
Interest and dividends	3,417,894	3,082,504
Renewal and replacement reserve	1,800,000	1,650,000
Balance	2,069,695	1,813,433
Louisiana Power & Light Company		
Gross earnings from operations	$2,926,376	$2,047,600
Operating expenses and taxes	1,693,318	1,150,772
Net earnings from operation	1,233,058	896,828
Mississippi Power & Light Company		
Gross earnings from operations	$2,638,310	$2,126,596
Operating expenses and taxes	1,628,161	1,381,615
Net earnings from operations	1,010,149	744,981
Idaho Power Company and Nevada Power Company		
Gross earnings from operations	$3,147,992	$2,876,588
Operating expenses and taxes	1,499,262	1,414,345
Total income	1,756,132	1,549,644
Interest and dividends	966,746	944,283
Renewal and replacement reserve	240,000	235,000
Balance	549,386	370,361
*Utah Power & Light Company**		
Gross earnings from operations	$12,228,627	$12,101,991
Operating expenses and taxes	5,743,134	5,700,729
Total income	6,823,018	6,816,755
Interest and dividends	4,623,741	4,519,303
Renewal and replacement reserve	750,000	775,000
Balance	1,449,277	1,552,452

* Includes also Western Colorado Power Company and Utah Light & Traction Company.

Power Use Gains 69 per Cent in New England Since 1921

In the past seven years the consumption of electric power generated in public utility plants in New England has increased 69 per cent, according to a chart prepared by the bureau of commercial and industrial affairs of the Boston Chamber of Commerce. Commenting upon this increase, the bureau states that power consumption is probably the best single index of manufacturing volume obtainable, and that while it is common knowledge that one or two of New England's hitherto "mainstay" industries have recently experienced declines of varying proportions, diversification is creating new prosperity for this section. It is noteworthy that electric power production, according to these data, rose from 3,214,000,000 kw.-hr. in 1921 to 5,471,000,000 kw.-hr. in 1927. During this period bank clearings increased from $17,339,900,000 to $30,359,000,000 and population from 7,533,510 to 8,182,428.



Healthy growth in power use apparent in New England

New York Not to Act on Rate Problem Now

No legal move will be made by the city of New York against the recently ratified Brooklyn Edison-Consolidated Gas merger at this time, it is stated, nor will any action be taken to enforce rate reduction until the merger organization has functioned for some time and has had the opportunity of making known its policy.

Laurentide Company Disposes of Holdings

The Laurentide Company, Ltd., has disposed of its holdings of Laurentide Power Company, Ltd., to the Shawinigan Water & Power Company at $150 in cash and one share of Shawinigan stock for each share of Laurentide Power Company, Ltd., stock. Meetings of the shareholders will be held soon in connection with the transaction. The Laurentide Company, a subsidiary of the Canada Power & Paper Corporation, holds 72,000 shares of Laurentide Power Company, Ltd., stock.

Insurance Companies Hold $1,064,000,000

The life insurance companies of the United States have invested $1,064,000,000 in the securities of public utilities, a larger total than that for any other group of securities except those of railroads, according to a report made by the Association of Life Insurance Presidents to the Department of Commerce. Assets of American life insurance companies aggregate more than $12,000,000,000, according to the report, and have increased 64 per cent, or more than $4,500,000,000, during the last five years. Bonds and stocks held by the companies represent 38 per cent of the total assets and include government securities totaling $943,000,000. Other items are: Railroad bonds, $2,359,000,000; public utility securities, $1,064,000,000; miscellaneous investments, $197,000,000.

Stock Exchange in Metropolitan Merger Under Way

The Consolidated Gas Company of New York delivered Aug. 27 by registered mail 4,320,000 new shares of stock to its stockholders under the plan approved on July 16 to split the common stock on a two-for-one basis and to increase the authorized shares from 4,320,000 to 12,000,000. The National City Bank as depository began delivery of two common shares and one preferred share of the Consolidated Gas Company to the holders of each share of Brooklyn Edison Company stock, thus completing the merger of the two organizations.

Wilson of Louisville Discusses Company's Change in Set-Up

The stockholders of the Louisville Gas & Electric Company of Kentucky at the annual meeting to be held in Louisville Sept. 10, 1928, will vote on the question of authorizing an increase in the total amount of preferred and common stocks from $45,000,000 to $90,000,000, as announced in the Aug. 25 issue of the ELECTRICAL WORLD. In discussing the proposed increase in capitalization, T. B. Wilson, vice-president and general manager of the company, said:

The funds provided through the sale of present outstanding stocks have been used for construction purposes and to extend the benefits of service to more customers and wider territories. The company has been a leader in public progress and has endeavored to keep pace with local development, stimulating industry and civic growth by supplying the highest grade of utility service. The board of directors anticipates that development will be at least as great in the future as in the past, and in order that the company may be in a position to meet these service demands authority is asked to amend the certificate of incorporation, increasing the issue of the stock.

The authority asked provides that the rates of dividend on preferred stock

hereafter issued shall be fixed by the board of directors before the issuance of same, but that in no event shall the rate exceed 8 per cent annually. In this connection Mr. Wilson said:

This provision is in accordance with modern practice and has been adopted in order to provide the elasticity so important to corporation finance. There is no intention at this time of issuing a preferred stock carrying a high rate, and when it is remembered that the first issuance the company made was 7 per cent stock, and the following one 6 per cent stock, which was later discontinued, it is reasonable to assume that any further issuance may be at a still lower rate. The granting of such authority does not anticipate that all or any substantial part of this additional stock is to be issued or sold in the near future. However, it is felt that this increase, if authorized, will provide for the company's requirements for many years to come.

North American Company Reports Increased Assets

In the president's quarterly letter to stockholders total assets of the North American Company and subsidiaries were shown to have increased from $700,716,429 for the twelve months ended June 30, 1927, to $811,582,951 for the twelve months ended June 30, 1928. Property and plant account was $105,000,000 higher, $698,486,365, as compared with $593,751,562. Investments amounted to $44,398,879, against $40,001,031. Reserves totaled $101,228,587, against $77,812,982, and surplus totaled $811,582,951, against $700,716,429. Current assets advanced to $48,168,639, from $47,787,630, and current liabilities dropped from $19,929,979 for the twelve months ended June 30, 1927, to $19,818,411 for the twelve months ended June 30, 1928, showing a gain in working capital of $492,000.

Money Market Outlook

Relative to the outlook for the money market in the immediate future, the Harvard Economic Bureau in its current letter says:

It now appears certain that money will remain firm—at least until the culmination of the autumn demands around the middle of October, and probably until the turn of the year.

A stock market break of proportions to release a large volume of funds would doubtless change this outlook considerably (especially if it enabled the reserve system to reverse its policy toward the money market). But the time is now so short that even a considerable reduction in brokers' loans would be counteracted by the autumn expansion of commercial borrowings.

Some further flow of funds to New York may occur, since rates are considerably higher than in London and Paris, a tendency which will be helped by a smaller volume of foreign loans. Moreover, our export trade will be expanding during the fall, and the contraction in foreign security flotations and the smaller volume of tourist expenditures will alike cut down the volume of our own payments abroad.

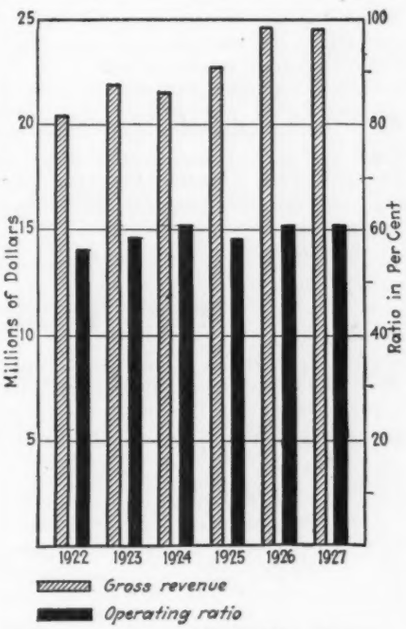
These various influences may result in some inflow of gold despite the efforts of European central banks to prevent such a movement, but this tendency will be counteracted, at least in part, by the usual outflow of gold to Canada in the late autumn.

Quite apart from a liquidation of loans such as would accompany a stock market break, furthermore, there may well be some liquidation of collateral borrowings as the present congestion in the bond market is relieved and the volume of new securities declines.

Rate Reduction Lowers Earnings of Consolidated of Baltimore

A SIX-YEAR survey of the progress of the Consolidated Gas, Electric Light & Power Company of Baltimore shows no spectacular expansion, but a steady, conservative growth in line with that of similarly situated operating companies the country over. Six years ago the company yielded a gross revenue from all sources of slightly over $20,000,000. The figure has not yet reached $25,000,000.

Analysis of the past two years' earnings statements at once raises the question, Why a decline in the 1927 gross against a gain of probably 8 per cent for the industry as a whole? The company's report cites a "large decrease in electric rates, the prevailing weather conditions and the general industrial and commercial situation." The first of these reduced electric gross revenue by nearly a million dollars a year. The climatic and industrial conditions carry a veiled implication of the benefits of diversification in the case of the large holding company groups. However, 1927 was an outstanding year in expansion of territory by extension of lines. This will reap fruit later.



Gross revenue of Consolidated company covering six-year period

	1927	1926
Gross revenue	$24,657,000	$24,710,603
Net revenue	7,899,975	8,130,766
Non-operating revenue	347,527	378,614
Fixed charges	3,070,132	2,929,771
Net income	5,177,370	5,579,609
Surplus after dividends	1,862,481	2,623,704

Consolidated of Baltimore has a somewhat detailed financial structure, being responsible for seven bond issues and having four classes of preferred, besides the common issue and a Public Service Building Company issue. The common has always been very highly regarded from an investment viewpoint. It pays $3 per share and is a no par stock. Last year earnings were around $4.58 on common. Present quotations of around $80 for the stock are therefore approximately eighteen times earnings, a not at all abnormal ratio for a company of this type.

Operating Ratio Steady

The company's operating ratio shows no definite trend in either direction over a period. Six years ago it was lower than at present. Last year it was 61.3 per cent, against 60.8 per cent the year before. The company's property investment, which stood at $106,309,715 at the end of last year, is approximately $4.31 per dollar of gross revenue, a considerably lower figure than the average for the industry. Electric properties alone at the end of 1927 amounted to $3.78 per dollar of gross income and during the period since 1910 $4.93 per dollar of gross.

An abridged earnings statement for the years 1926 and 1927 is shown in the accompanying table.

Engineers Public Service Declares Initial Dividend. — Directors of the Engineers Public Service Company have declared an initial quarterly dividend of $1.25 per share on the $5 dividend convertible preferred stock, payable Oct. 1 to holders of record Sept. 5.

Commonwealth Power Approves Stock Increase.—Stockholders of the Commonwealth Power Corporation on Aug. 7 approved the creation of an authorized issue of 50,000 shares of no-par value preferred stock. Previously the corporation had authorized an outstanding $50,000,000 issue of 6 per cent cumulative preferred stock, par $100.

Recent Listings.—There have been placed on the Boston Stock Exchange list 50,000 shares of the Cities Service Power & Light Company's no-par value $5 dividend cumulative preferred stock. The New York Stock Exchange has authorized the listing of 320,000 shares of $5 dividend convertible preferred stock of the Engineers Public Service Company of no-par value and the Boston Exchange has authorized a similar amount.

Current Earning Reports of Utilities Satisfactory

	1928	1927	Per Cent Increase	Operating Ratio 1928	Operating Ratio 1927
American Lt. & Traction & Subs. (Year Ended June 30)					
Gross earnings	$38,656,763	$36,080,320	7.2	66	69
Net earnings	12,789,591	11,126,336	14.9	..	..
Associated Gas & Elec. System (Year ended May 30)					
Gross earnings	42,006,909	31,831,775	32.0	57	54
Net earnings	18,167,902	14,667,808	24.0	..	..
Carolina Power & Light (Year ended June 30)					
Gross earnings	8,945,636	8,683,247	3.0	52	53
Net earnings	4,268,362	4,110,951	4.0	..	..
Columbia Gas & Elec. & Subs. (Year ended June 30)					
Gross earnings	101,776,636	96,058,586	5.9	48	55
Net earnings	33,992,934	30,116,836	12.8	..	..
Consumers Power (Year ended July 31)					
Gross earnings	28,712,549	25,764,691	11.4	50	52
Net earnings	14,214,707	12,517,867	13.6	..	..
Milwaukee Electric Ry. & Lt. (Year ended June 30)					
Gross earnings	28,037,267	26,642,537	5.23	68	68
Net earnings	9,086,520	8,455,683	7.46	..	..
New Orleans Public Service (Year ended June 30)					
Gross earnings	18,594,325	18,027,258	3.0	61	63
Net earnings	7,131,773	6,690,817	7.0	..	..
New York Power & Light (Year ended July 31)					
Gross earnings	19,796,680	18,297,500	8.1	58	55
Net earnings	11,488,719	11,158,022	2.9	..	..
Public Service Electric & Gas* (Year ended June 30)					
Gross earnings	83,579,147	76,365,893	9.4	65	68
Net earnings	29,243,822	24,531,675	19.2	..	..
Southern California Edison* (Seven months ended July 31)					
Gross earnings	20,041,903	17,635,032	14.0	33	63
Net earnings	13,541,225	11,939,827	13.0	..	..
Stone & Webster Subs.* (Year ended June 30)					
Gross earnings	72,539,972	69,115,484	4.9	61	53
Net earnings	28,427,188	25,829,873	10.0	..	..
Tennessee Electric Power (Year ended July 31)					
Gross earnings	12,983,519	12,288,863	5.7	47	53
Net earnings	6,041,261	5,713,557	5.7	..	..
West Penn Electric & Subs. (Year ended June 30)					
Gross earnings	37,532,267	36,076,919	4.0	55	54
Net earnings	16,879,678	16,513,083	2.2	..	..

*Operating expenses not included in report. Taken as difference between gross and net for computing operating ratio.

Utilities Reports Encouraging

Many utilities report monthly and yearly their gross and net earnings. The accompanying table of current reports shows a very healthy growth in business on nearly all properties. The leaders in per cent increase in gross earnings are the Associated Gas & Electric System, the Southern California Edison Company and the Consumers Power Company. Each of these utilities has been very aggressive in load-building efforts during the past year.

The revamping of properties to secure operating economy has had the effect of increasing net earnings. A notable example of the possibilities in operating economies is found in the report of the Public Service Electric & Gas Company. The gross increased 9.4 per cent, but the net was up 19.2 per cent. A similar increase in net is noticed in the Stone & Webster properties. A wide diversity in the magnitude of operating ratio is found as between properties, as might be anticipated, and no general trend is noticeable. Some are high and shifts are found both up and down.

These reports check the figures on kilowatt-hours produced in that revenues are increased as well as energy sales and the generally satisfactory net earnings give promise of a very good year in the utility business for all these properties.

PACIFIC LIGHTING STOCKHOLDERS GIVEN RIGHTS.—Holders of common stock of the Pacific Lighting Corporation of record Sept. 1 will be given the right to subscribe at $50 per share to 113,646 additional shares of common stock in the proportion of one share of additional stock for each ten shares of common stock held. The subscription privilege will expire Oct. 31.

Utility Financing Recovers

NEW securities of the electric light and power companies of the country offered during the month of August amounted to $85,968,000, a figure which indicates a marked recovery from the slump in July, when only a little in excess of $4,000,000 was recorded, and a substantial increase over June, when $23,000,000 was recorded. August brings to a close the eight-month period with a total of $846,703,852, as compared with $943,416,700 for the similar period of 1927.

The largest individual loan of the month was raised by the Central States Power & Light Corporation in the form of preferred stock, a piece of financing involving a total of $21,670,000. Though three short-term issues appeared, long-term financing predominated. The average yield amounted to 6.12 per cent, the highest since the summer of 1925.

Security Issues of Electric Service Companies in August

Name of Company	Amount of Issue (Par Value)	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
American Utilities Co.	$438,000	15	Gold debentures		6½	100	6.50
	1,000,000	17	First lien and refunding gold bonds, series A		6	100	6.50
Middle West Utilities Co.	10,000,000	1	Serial gold notes	To reimburse treasury for funds used in	5½	99.88	5½
	10,000,000	2		development of its subsidiary companies and for general corporate purposes.	5½	99.30	5½
	10,000,000	3			5½	98.65	6
Commonwealth Subsidiary Corp.	20,000,000	20	Gold debentures, series A		5½	97	5.75
Central States Power & Light Corp.	21,670,000	..	Preferred stock	To provide part of the funds for acquisition of properties and for other corporate purposes	7	98½	7.10
Midland Utilities Co.	6,000,000	10	Gold debentures, series A	To develop subsidiary companies, refunding indebtedness and for general corporate purposes	6	99½	6.05
Federal Public Service Corp.	540,000	19	First lien gold bonds	To acquire new subsidiaries, for the payment of maturing indebtedness, for working capital and for general corporate purposes	6	100	6
Public Service of Pennsylvania, Inc.	500,000	25	First lien and collateral trust gold bonds, series A	To acquire securities of subsidiaries and for other corporate purposes	5½	98½	5.60
Colonial Utilities Corp.	750,000	30	First lien gold bonds	To acquire stocks of constituent companies, to provide working capital and for general corporate purposes	5½	98½	5.60
Public Service Co. of Oklahoma	70,000	..	First preferred stock		6½	100	6.50
	5,000,000	29	First mortgage gold bonds, series D	Acquisition of additional property and for other corporate purposes	5	96	5.27
Total	$85,968,000	(Par Value)	Rights		$6,548,500		
Total amount actually realized	84,577,200		Total financing for August		91,125,700		

Business News and Market Conditions

N.E.M.A. Handbook of Apparatus Standards

Test, performance and manufacturing standards of electrical apparatus have just been published as the N.E.M.A. Handbook of Apparatus Standards, formerly known as the Electric Power Club Handbook of Apparatus Standards. The book embraces standards of electric power, control and measuring apparatus for the generation, distribution and utilization of electric energy. Each section of the handbook, covering such apparatus as motors and generators, industrial control, transformers, switchgear, measuring instruments, electric welding, etc., is complete in itself, all the rules relating to each product being grouped together. Standard definitions, abbreviations and symbols are also included for each class of apparatus.

The question of how long a manufacturer should keep tools and patterns for supplying customers with spare parts is covered very fully under the heading Business Policies, together with customer's obligations in this connection. Under the heading Application and Selection of Rotating Apparatus, the proper service factors are given. These are multipliers to be applied to the horsepower ratings of standard motors for use in special applications or under special service conditions which are also defined. Full information is given regarding the effects of variation of voltage and frequency upon the performance

Value and Destination of Electrical Exports for June, 1928, Compared with Corresponding Month in 1927

(Issued by Bureau of Foreign and Domestic Commerce)

Article	June 1927	June 1928
Generators:		
Direct Current:		
Under 500 kw.	66,168	90,591
500 kw. and over	29,025	23,549
Alternating current:		
Under 2,000 kva.	5,789	7,030
2,000 kva. and over	.....	74,274
Steam turbine generator sets	90,283	23,698
Accessories and parts for generators	119,657	116,373
Self-contained lighting outfits	115,965	111,889
Batteries:		
Flashlight batteries	165,325	209,514
Other dry and wet cell primary batteries	204,526	281,939
Storage batteries	303,870	292,000
Transforming or converting apparatus:		
Power transformers	79,750	*
Power transformers, 500 kva. and over	*	134,972
Distribution transformers, less than 500 kva.	*	40,362
Other transformers	114,326	*
Instrument transformers	*	4,171
Other transformers, not elsewhere specified	*	54,802
Battery chargers under 15 amp.	*	23,043
Rectifiers, double current and motor generators, dynamotors, synchronous and other converters	138,632	127,377
Transmission and distribution apparatus:		
Switchboard panels, except telephone	94,473	67,977
Switches and circuit breakers over 10 amp.	116,100	123,208
Fuses and fuse blocks	32,683	43,520
Watt-hour and other measuring meters	71,818	64,150
Volt, watt, and ampere meters, and other recording, indicating, and testing apparatus	140,553	*
Electrical indicating instruments	*	39,329
Electrical recording instruments	*	14,419
Other electrical testing apparatus	*	65,005
Lightning arresters, choke coils, reactors and other protective devices	33,703	58,622
Motors, starters and controllers:		
Motors under 1 hp.	192,227	*
Motors ¼ hp. and under	*	227,056
Motors over ¼ hp and under 1 hp.	*	103,546
Stationary motors:		
1 to 200 hp.	228,947	188,695
Over 200 hp.	27,636	33,131
Railway motors	12,266	12,438
Electric locomotives:		
Railway	.....	4,552
Mining and industrial	67,404	81,250
Station and warehouse electric motor trucks	24,425	22,574
Starting and controlling equipment:		
For industrial motors	94,001	114,561
For electric railway and vehicle motors	4,618	51,709
Portable electric tools	96,225	139,407
Accessories and parts for motors	200,557	204,585
Electric appliances:		
Electric fans	96,239	104,043
Electric lamps:		
Metal filament	139,440	106,967
Other electric lamps	27,928	33,016
Flashlights	180,491	237,070
Searchlights and projectors	66,617	55,068
Motor-driven household devices:	257,158	*
Electric vacuum cleaners	*	138,162
Other motor-driven devices, except tools	*	85,871
Domestic heating and cooking devices:	104,792	*
Electric flatirons	*	31,846
Electric cooking ranges	*	14,633
Other domestic heating and cooking devices	*	67,636
Industrial electric furnaces and ovens	33,375	44,611
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	145,107	136,232
Signal and communication devices:		
Radio apparatus:		
Transmitting sets and parts	5,806	49,776
Receiving sets	174,433	228,983
Tubes	112,756	90,787
Receiving-set components	172,902	200,189
Receiving-set accessories	134,197	151,955
Telegraph apparatus	52,898	60,728
Telephone apparatus:		
Telephone instruments	35,474	36,823
Telephone switchboards	10,233	112,066
Other telephone equipment	142,571	182,062
Railway signals, switches and attachments	66,444	133,103
Bells, buzzers, annunciators, and alarms	31,323	26,543
Other electric apparatus:		
Spark plugs, magnetos, and other ignition apparatus	196,054	*
Spark plugs	*	147,696
Other starting, lighting, and ignition equipment	*	116,691
Insulating material	120,020	111,779
Metal conduit, outlet, and switch boxes	88,395	137,405
Sockets, receptacles, and lighting switches	133,332	185,729
Electric lighting fixtures, interior and street	126,233	*
Electric interior lighting fixtures	*	170,511
Electric street lighting fixtures	*	39,111
Other wiring supplies and line material	78,914	67,386
Other electrical apparatus not elsewhere specified	523,407	626,504
Rubber and friction tape	30,374	38,155
Globes and shades for lighting fixtures	55,594	51,139
Electrical glassware except for lighting	16,929	28,352
Electrical porcelain:		
For less than 6,600 volts	53,988	50,664
For 6,600 volts and over	14,785	50,304
Carbons, carbon brushes, and electrodes:		
Electrodes for electric furnaces	156,212	185,762
Other carbon products	88,477	57,576
Insulated wire and cable (iron or steel)	5,754	6,383
Copper, bare wire	129,541	183,325
Copper, insulated wire and cable	419,052	483,991
Refrigeration sets up to 1 ton capacity	430,971	744,454
Domestic washing machines	133,985	156,915
Totals	$7,663,154	$9,243,320

*Changes in classification provide no comparable data available.

DESTINATION OF ELECTRICAL EXPORTS

Country of Destination	June, 1928
EUROPE:	$1,975,195
Belgium	255,093
France	189,284
Germany	91,803
Italy	157,679
Netherlands	55,127
Spain	130,347
Sweden	57,696
United Kingdom	733,042
Other countries	305,124
WESTERN HEMISPHERE:	$5,452,778
Canada	2,412,075
Mexico	486,653
Cuba	237,218
Argentina	777,210
Brazil	451,411
Chile	193,550
Colombia	205,317
Peru	59,177
Venezuela	148,993
Other countries	481,174
ASIA, AFRICA AND OCEANIA:	1,815,347
British India	213,049
China	177,905
Japan	299,314
Philippine Islands	98,708
Australia	549,016
New Zealand	138,599
Union of South Africa	105,535
Other countries	233,221

of induction motors. This information is specially valuable for the application of standard motors on the off voltages of some of the network distributing systems being installed by electric light and power companies.

Upon the request of some pump and machinery manufacturers, the lettering of dimension sheets for horizontal and vertical motors was standardized and is included in the handbook. American standard connections and terminal markings of motors, generators, converters and transformers are given in full. The section on Industrial Control includes the rules approved as "American Standard" by the American Engineering Standards Committee, with additional standards and recommendations adopted by N.E.M.A. and not yet presented to the American Engineering Standards Committee for adoption.

Power, distribution and instrument transformer standards are given in full. The section on switchgear includes standards for the manufacture, test and performance of power switchboards, oil circuit breakers, safety inclosed switchboards, automatic switchboards, high voltage switching equipment and fuses. Forms are also given standardizing the information to be furnished the purchaser with specifications in proposals for this equipment. Ratings of direct current arc welding sets are specified, together with the test and performance specifications which these sets should meet. The price of the handbook is $3, postpaid.

Effect of Power in Industries

A comparison of power used in industries in the United States and in Great Britain, prepared by the National Industrial Conference Board, shows the use of power and of mechanized mass production accounts largely for the high wage levels and living standards in this country. The report says that eight electric manufacturing industries in the United States which use on an average one-and-a-half times as much horsepower per wage earner as the same industries in Great Britain turn out, largely as a result of this greater use of power, from two-and-a-half to three times as much production for each wage earner employed. A striking difference exists in the rate of production of automobiles and of electrical machinery in the two countries. The amount of horsepower and the value added by manufacture per wage earner in each of the eight industries compared in the two countries are given in the accompanying table. The data for Great Britain refer to the year 1924, and those for the United States to 1925.

COMPARISON OF POWER USED IN INDUSTRY, GREAT BRITAIN AND UNITED STATES

Industry	Horsepower per Wage Earner	Value Added per Wage Earner
Steel wks. and rolling mills		
Great Britain	9.15	$975
United States	12.85	3,059
Machinery:		
Great Britain	2.60	997
United States	3.62	3,325
Motor vehicles:		
Great Britain	1.13	1,206
United States	2.75	4,096
Electrical machinery:		
Great Britain	1.28	1,196
United States	2.46	3,765
Shipbuilding:		
Great Britain	2.70	783
United States	6.04	2,208
Cotton goods:		
Great Britain	3.14	725
United States	5.02	1,431
Woolen and worsted goods:		
Great Britain	1.97	874
United States	3.28	2,164
Boots and shoes:		
Great Britain	0.48	846
United States	0.67	2,144

Market Conditions

ORDERS are being placed in good volume in the New England district and in common with virtually all centers of the country the general tone of business is encouraging. A number of industrial plant orders are pending including heavy equipment and turbo-generator units. Industrial electric heating and arc-welding apparatus are in demand. Sales are active in the Eastern district. An order was placed for a generator for a muncipal hydro-electric power installation in Tennessee and contracts were closed for a water-wheel and generator installation in Texas. There is a steady demand for motors. Mining companies have been active purchasers and marine equipment business continues to develop. In the Southeast the volume of business is being sustained. An order for pole-line construction materials amounted to $24,000. Industrial plant orders included $12,000 worth of motor equipment for a lumber mill in Louisiana and $10,000 worth for a textile plant in Georgia.

Sales in the St. Louis district are normal with orders for stock apparatus being placed in steady volume. Orders reported include $5,500 worth of feeder regulators for southern Illinois and a 3,000-kw. turbo-generator unit, costing $85,000, for a local manufacturing concern. Improvement continues in the Middle West. Maintenance purchases have been heavy with a good demand for pole-line hardware and insulators. On the Pacific Coast power company inquiries have been good and include such items as two carloads of conduit, two carloads of weatherproof wire and eight carloads of poles. Railroad inquiries are exceptionally good and street-lighting equipment continues in active demand. About Jan. 1 Seattle's municipal lighting department will call for bids for furnishing and erecting a 120-mile transmission line from the Gorge Creek hydro-electric plant to Seattle to cost about $1,800,000.

Lead Prices Advance— Copper and Zinc Steady

Active buying of lead was again the feature of the domestic markets in non-ferrous metals. Two advances in the price, bringing it to 6.40 cents, New York, served only to whet the appetites of consumers and the volume of sales in the aggregate exceeded the exceptional record of the preceding week. Copper was rather quiet, but some business was done each day and the price was firmly maintained at 14.75 cents, Connecticut. A normal turnover of zinc is reported with the price unchanged at 6.25 cents, St. Louis. Tin sagged somewhat and in London the backwardation narrowed, indicating weakness in the position.

NEW YORK METAL MARKET PRICES

	Aug. 22, 1928 Cents per Pound	Aug. 29, 1928 Cents per Pound
Copper, electrolytic	14.75	14.75
Lead, Am. S. & R. price	6.20	6.40
Antimony	10.25	10.3125
Nickel, ingot	35	35
Zinc, spot	6.625	6.60
Tin, Straits	48	47.625
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Aug. 29, 1928, 16¼ cents.

Volume of Business Sustained in Southeast

A sustained volume of business with no outstanding features is reported in the Southeast. The largest central-station order was for pole-line construction materials amounting to $24,000, while another company ordered creosoted pine poles totaling $10,500 and crossarms and pins totaling $1,050. One of the smaller companies ordered poles, distribution transformers and meters amounting to $8,000 and some other central-station orders were for small power and distribution transformers amounting to $6,400 and steel wire totaling $5,800. One company's meter orders aggregated $3,600 for watt-hour meters and $1,200 for voltmeters.

A lumber mill in Louisiana ordered motor equipment amounting to $12,000, while a small textile plant in Georgia ordered motors to the extent of $10,000 on a plant electrification project. A club in Georgia is putting in an all electric kitchen and has ordered heavy-duty cooking equipment with a connected load of 64 kw. A contractor in Augusta, Ga., ordered wiring supplies aggregating $3,000 for an apartment job in that town. The city of Atlanta ordered wiring supplies amounting to approximately $2,000 for rewiring certain of the public schools. Construction projects are as follows:

The Sumter Rayon Mills, Americus, Ga., will build a plant to cost $100,000. The Cumberland Hydro-Electric Power Company, Louisville, Ky., has secured permission for a hydro-electric development

on the Cumberland River and Wolf Creek, to cost $15,000,000. The N. & W. Overall Company, Lynchburg, Va., plans a plant at Jackson, Miss., to cost $100,000. The Carolina Container Company, High Point, N. C., recently organized, will build a plant to cost $100,000. The Southern Weaving Company, Greenville, S. C., plans an addition to cost $100,000.

The United States Engineer Office, Chattanooga, Tenn., will receive bids until Sept. 21 for Diesel engine units, complete with generators, exciters, propulsion control, motors, switchboard, etc. The Kingsport Silk Mills, Kingsport, Tenn., plans a unit to cost $100,000. E. I. duPont de Nemours & Company, Wilmington, Del., plans a carbon bisulphide mill at Old Hickory, near Nashville, Tenn., to cost $200,000. The West Virginia Rail Company, Huntington, W. Va., will make extensions in its steel and iron works to cost $400,000. Petersburg, Va., plans an improved lighting system.

Sales Activity Increases in Eastern District

An excellent tone prevails in the Eastern district and with but few exceptions primary equipment is in good demand. While industrial account is exceeding central-station business, utility inquiries are becoming more prominent and a few weeks is expected to show marked upward trend for latter commitments. A manufacturer has secured a contract for a generator for a municipal hydro-electric power installation in Tennessee. Two manufacturers have contracted for a waterwheel and generator installation, respectively, for a central station in Texas. Substation equipment shows a tendency to lag and inquiries have gone below normal. A few sales have been recorded for transformers, but the majority of transactions are for smaller capacity units. An increase in demand is expected within 30 to 60 days.

The call for motors is a feature of present market activity and sizable commitments are being made. A manufacturer reports an increase of 50 per cent in sales during August as compared with the corresponding month of last year. The peak of demand is centered in units ranging up to 15 hp. rating, with industrial types finding their way into cement mills, textile mills, leather plants, chemical plants and iron and steel works. A central-station company has purchased a quantity of condenser type units. Mining companies have been active purchasers during the past few weeks for heavy type motors, as well as for other electrical equipment.

Marine equipment business continues active. A manufacturer has secured a large order for a complete installation for a new liner for Panama-Pacific intercoastal service, heavy tonnage type. Good fall commitments are expected for this account. An Eastern steam railroad has contracted for a 300-hp. oil-electric locomotive, making the fourth such unit purchased from a leading maker. Electric control equipment for industrial service is in good demand, with Eastern printing plants among the active purchasers. Construction activities in the Eastern district are as follows:

The Manhattan Refrigerating Company, New York, plans an addition to cost $100,000. The New York Power & Light Corporation, Albany, N. Y., plans extensions in transmission lines in Washington County. The Nostrand Manufacturing Company, Plattsburg, N. Y., recently organized to succeed the Saranac Pulp & Paper Company, will make extensions in mill, including new power plant, to cost $150,000. The Bessemer Limestone & Cement Company, Youngstown, Ohio, plans a storage plant at Buffalo, N. Y., to cost $100,000. The Consolidated Instrument Company of America, Inc., New York, plans an assembling plant and laboratory, to cost $125,000. The International Nickel Company, New York, will install hydro-electric and other power equipment at Port Colborne, Ont., Canada. The Triplex Safety Glass Company, Hoboken, N. J., plans a plant at Clifton, N. J., to cost $500,000. The Victor Talking Machine Company, Camden, N. J., plans a plant at Sao Paulo, Brazil, to cost $500,000. The Beacon Oil Company, New York, plans a storage plant at Brooklyn to cost $160,000.

The Haddock Mining Company, Hazleton, Pa., plans a coal washing plant to cost $80,000. The United Railways & Electric Company, Baltimore, Md., plans a motor bus station to cost $200,000. The J. Phillip Sausage Company, Washington, D. C., will build a plant to cost $175,000. The Standard Wholesale Phosphate Company, Baltimore, Md., plans additions in its sulphuric acid plant to cost $150,000. The Standard Oil Company, Baltimore, Md., will make additions in its refining plant to cost $180,000. The Supervising Architect, Treasury Department, Washington, D. C., will receive bids for motor-generator sets, etc., for the U. S. Mint, Philadelphia, Pa., until Sept. 18. The General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until Sept. 10 for a quantity of single-conductor copper wire, rubber-insulated cable, etc., four transformers, two oil circuit breakers, and other equipment (Panama Circular 1898). The Bureau of Supplies and Accounts, Washington, D. C., will receive bids until Sept. 11 for electric hoists, trolleys, etc. (Schedule 9595).

Orders Holding Up Well in New England

The general tone in the New England district is encouraging. Orders for small motors are being received in good volume. One manufacturer records sales amounting to $30,000 and another reports a steady demand for fractional-horsepower motors. Control and switch equipment is moving well and sales of automatic starting boxes are reported encouraging. Several 10-hp. to 50-hp. motors were sold.

Heavy equipment sales are quiet, while a number of orders for transformers were placed. Industrial equipment orders are pending, including a number of turbo-generators. Central-station supplies are attracting interest, poles, crossarms and wire are active, and fiber conduit and black pipe shipments are steady. Industrial electric heating and arc-welding apparatus are active. An order was received for a large automatic seam welder and two portable units were ordered for local use. Construction projects are as follows:

The United States Aluminum Company, Pittsburgh, Pa., plans a plant at Fairfield, Conn., to cost $350,000.

Improvement Continues in Middle West

Good business is apparent throughout the Middle West. Building activity is continuing at a high level, with an increasing number employed. The automotive industry shows signs of expansion and reports of the steel industry are satisfactory. Reports from mail order houses indicate a satisfactory condition in the agricultural districts. Utility companies are busy extending service lines and many small construction jobs are under way. Interesting orders placed include 94 73-kv., 600-amp., S.P.S.T., 230-volt direct-current motor-operated disconnecting switches, a construction order for a piping system for a 208,000-kw., triple-compound turbo-generator set and six boilers and auxiliaries valued at $1,000,000, additions to switch and frequency changer house valued at $150,000, structural steel valued at $25,000 and 100,000 lb. of solder. Maintenance purchases have been running heavy, with a good demand noted for pole-line hardware and insulators, and jobbers' sales remain satisfactory. Construction projects are as follows:

The Chicago Portrait Company, Chicago, plans a factory to cost $150,000. W. H. Hutchinson & Son, Chicago, manufacturers of bottling machinery, plan a plant to cost $200,000. The Bowman Dairy Company, Chicago, plans an addition to its plant in the Highland Park district, to cost $100,000. The Burkhartsmeier Cooperage Company, Chicago, will build an addition to cost $100,000. The Commonwealth Edison Company, Chicago, plans a substation. The Pellar Pie Company, Chicago, plans a plant to cost $500,000. The Public Service Company of Northern Illinois, Chicago, will build an equipment storage and distributing plant at Maywood, Ill., to cost $100,000. Springfield, Ill., plans a power substation to cost $55,000. F. Hilgemeier & Brother, Inc., Indianapolis, Ind., plans a refrigerating plant to cost $150,000. The Iowa Electric Company, Cedar Rapids, Iowa, will build a transmission line from Fairfield to Farmington. Allegan, Mich., plans a hydro-electric plant to cost $500,000.

The Federal Stamping Company, Holland, Mich., will make extensions in its plant to cost $400,000. The Olds Motor Works, Lansing, Mich., plans plant units to cost $600,000. The Schust Company, Saginaw, Mich., plans a candy manufacturing plant to cost $200,000. Vassar, Mich., will make extensions in its power plant to cost $60,000. The Goodrich Rubber Company, Akron, Ohio, plans additions to cost $120,000. The Cleveland Electric Illuminating Company, Cleveland, plans a substation to cost $100,000. The Midland Steel Products Company, Cleveland, will make extensions in its plant to cost $250,000. The Aetna Rubber Company, Cleveland, plans a plant at Ashtabula, Ohio, to cost $200,000. The General Aeronautical Corporation, Cincinnati, Ohio, plans an aircraft manufacturing plant to cost $90,000. The State Department of Public Welfare, Columbus, Ohio, will soon take bids for a

new power plant at its institution in the Apple Creek district to cost $60,000. The Hinde & Dauch Paper Company, Sandusky, Ohio, plans a mill at Winnipeg, Man., Canada, to cost $800,000. The Willys-Overland Company, Toledo, Ohio, plans an addition to cost $100,000. The National Lumber & Creosoting Company, Texarkana, Ark., plans a plant at Superior, Wis., to cost $200,000.

Business Is Normal in St. Louis District

There has been no marked change in business conditions in the St. Louis district. Sales managers report that business is normal and orders covering stock sizes of apparatus hold steadily. An order was placed for a lot of induction feeder regulators amounting to $5,500 for shipment to southern Illinois. A contract was let for a 3,000-kw. turbo-generating unit to a manufacturing company for $85,000. Construction projects are as follows:

The Arkansas Portland Cement Company, Saratoga, Ark., will build a unit to cost $250,000. The Roxana Petroleum Company, St. Louis, plans additions to its oil refinery at Arkansas City, Kan., to cost $400,000. The Blue River Power Company, Topeka, Kan., plans a power plant at Marysville, Kan., to cost $100,000. The Cook Paint & Varnish Company, Kansas City, Mo., plans a lacquer manufacturing plant to cost $90,000. St. Louis, Mo., plans an addition to its power plant at Koch, Mo., to cost $50,000. Austin, Tex., is having surveys made for a municipal power plant. The Quartermaster Supply Office, Fort Sam Houston, Tex., will receive bids until Sept. 6 for one automatic switchboard panel, one watt-hour meter, conduit cable, etc. (Circular 74.)

The Houston Lighting & Power Company, Houston, Tex., plans an equipment storage and distributing plant near the Navigation Boulevard to cost $70,000. The Central Power & Light Company, San Antonio, Tex., plans a hydro-electric plant on the Devil's River to cost $500,000. Sherman, Tex., is concluding arrangements with the Texas Power & Light Company, Dallas, for extensions to its lighting system.

Utilities and Railroads Active on Pacific Coast

Power company inquiries on the Pacific Coast include two carloads of rigid iron conduit, two carloads of double-braid weatherproof wire, six carloads of poles for the Eureka district and two carloads for Roseville and 3,000 assorted fuses. Railroad inquiries are exceptionally good and include eight carloads of iron wire, two carloads of steel strand, one carload of steel pins, two carloads of glass insulators and a year's requirements of dry batteries and flashlight batteries totaling about 30,000 and 3,000 respectively.

A manufacturer reports increasing sales on flashlights and batteries and practically no decrease on radio battery sales. Fan sales have been disappointing. Street lighting business includes an $800 award by Sunnyvale and a prospective installation of 323 duplex electroliers in downtown Oakland. Santa Cruz, too, is figuring on an installation. The San Francisco November ballot will contain bond issues totaling $16,000,000, including $5,000,000 worth of civic center buildings.

Sales of one 240-hp. engine-generator set to an Alaskan mine and in excess of 100 motors, mainly small sizes, to lumber mills and allied industrials were reported in the Puget Sound district. Specifications are being written by a Seattle cement company for about 50 small motors ranging from 2 to 50 hp. and the city of Seattle within a month will buy 50,000 lb. of weatherproof copper wire and a carload of transformers.

About Jan. 1 Seattle's municipal lighting department will call for bids for materials and labor involved in erecting 120 miles of transmission line from the Gorge Creek hydro-electric plant to Seattle, the line to be 165,000-volt, three-phase, costing complete $1,800,000. The Beaver Portland Cement Company, Gold Hill, Ore., plans the expenditure of $200,000 for increasing its 500-hp. hydro-electric plant to 3,200 hp. Vancouver, Wash., has opened bids for two street-lighting jobs involving about $31,000. Construction projects are as follows:

The Central Arizona Light & Power Company, Phoenix, Ariz., plans a power substation. The Yuba River Power Company, San Francisco, has secured permission for a hydro-electric development on the Yuba River, to cost $35,000,000. The Marin County Milk Company, San Rafael, Calif., plans a plant to cost $125,000. The Northern Pacific Railway Company, St. Paul, Minn., plans a repair shop at Laurel, Mont., to cost $200,000. The Puget Sound Power & Light Company, Seattle, Wash., plans a substation at Bellingham, Wash. Los Angeles, Torrance, San Jose, Oroville and Visalia, Calif., and Butte, Mont., plan ornamental lighting systems.

Activities of the Trade

Anaconda Buys Properties of Late Senator Clark

The mineral, timber and banking properties of the late Senator W. A. Clark have been sold to the Anaconda Copper Mining Company. C. F. Kelley, president of Anaconda, in a statement concerning the purchase, said: "The Metals Bank & Trust Company of Butte is taking over and will conduct the banking business of Clark & Brother. In view of the importance of the transactions, Anaconda believes that by merging respective operations with its operations the interests acquired can be made not only profitable to it but also to contribute a more lasting and greater importance to the industrial prosperity of the state than under any other possible arrangement. Among the properties conveyed are a large number of undeveloped mining claims favorably situated in the Butte district, upon which active work will be undertaken, in the expectation that by so doing mines will be added to the payroll and permanence of Butte's mining industry may be devloped. The properties were taken over for a cash consideration."

THE STANDARD ELECTRIC STOVE COMPANY, Toledo, Ohio, announces that F. W. Schreiber, formerly sales manager of the Toledo Rubber Company, has become associated with the company. Mr. Schreiber will cover lower Michigan and northern Indiana.

THE NATIONAL LAMP WORKS of the General Electric Company, Nela Park, Cleveland, announces a new home assortment carton containing six lamps of the various wattages that are most generally used in the average home. This assortment may be bought in three different types of homes, Colonial, Old English and Spanish, and are colored in red, green and black.

THE HURLEY MACHINE COMPANY, 22d Street and 54th Avenue, Chicago, manufacturer of "Thor" washing machines, ironers, etc., has announced that it will build a new addition to its factory at a cost of $350,000. The new unit will be completed about Nov. 1, 1928.

THE EDWIN L. WIEGAND COMPANY, 422 First Avenue, Pittsburgh, manufacturer of electrical heating units, announces that the Southern Engineering & Supply Company, 2001 North Avenue, Richmond, Va., has been appointed sales and engineering representative for the state of Virginia.

THE INGERSOLL-RAND COMPANY, 11 Broadway, New York, has received an order from the Erie Railroad Company for a 300-hp. oil-electric locomotive. The equipment will be furnished in conjunction with the General Electric Company and the American Locomotive Company.

THE EAGLE ELECTRIC MANUFACTURING COMPANY, 59 Hall Street, Brooklyn, N. Y., announces the new Eagle smokers' desk lamp, the Eagle desk lamp and the Eagle reversible toaster, each furnished complete with 6-ft. cord and attachment plug.

THE R-F ELECTRICAL MANUFACTURING COMPANY, Augusta, Kan., has placed on the market a vibrating and exercising machine known as the "Vitalizer," designed to harmonize with the fittings of any room in which it may be placed.

THE WAGNER ELECTRIC CORPORATION, St. Louis, announces that Charles J. Arthur is now salesman of its Philadelphia branch sales office. Mr. Arthur was recently sales engineer for the A. R. Amos, Jr., Company of Philadelphia.

New Equipment Available

Automatic Starters

A new series of alternating-current automatic starters has been introduced by the Industrial Controller Company, Milwaukee. The starters will be known as Classes 8526 and 8536 (50-amp. size). Besides providing low voltage and either magnetic or thermal overload protection, these starters are said to have many other features. They will supersede the Classes 8527 and 8537.

Some of the features incorporated in this new apparatus are: New type quick detachable contact fingers, extra heavy magnet coil which provides unusual sealing pressure, floating armature which eliminates magnetic hum, self-aligning bearing bronze bushings, powerful magnetic blowouts, a new form of interlock, and plenty of wiring space. The starter has a baked enamel finish and is furnished in three types—with the push button in the cover, without any push button, or with a three-point switch in the cover.

Dinkey Controller

A new Dinkey controller placed on the market by the Electric Controller & Manufacturing Company, Cleveland, is said by the manufacturer to have the following outstanding features: Ebony asbestos in place of slate, ventilated contacts raised $\frac{1}{16}$ in. from the dial face, contact supporting lugs attached to the front of the dial and removable from the front, contact lug with a single square-head set screw to clamp the lead wire tightly, welded steel frame, main arm carried on ball bearings, smooth-center top of notch top and roller type, bearing spider casting supporting the dial as well as the arm and quadrant bearings to insure correct alignment and even contact pressure, and nickel alloy resistors which are guaranteed against breakage in shipment and in service for one year.

Porcelain Primary Cutout

The new type ES primary fuse cutout is announced by the Westinghouse Electric & Manufacturing Company. The type ES cutout is especially adapted to outdoor pole mounting for the protection of distribution transformers and is manufactured in two sizes, 60 amp. and 150 amp. for voltages up to 7,500. Both the housing and the cover of the cutout are made of wet-process porcelain, similar to that used for large line insulators. Protection of the cutout from rain is secured by the extension of the top of the housing beyond the cover and of the sides of the top beyond the housing. A deep groove in the rear of the housing, with a beaded section for preventing the entrance of rain, considerably increases the creepage distance between the line and the ground. Entrance wires may be installed either from right or left side, or in and out on the same side. A special insulating fuse tube of molded "Micarta" with internal non-carbonizing lining and brass end terminals is used. The interrupting capacity of the 60-amp. cutout is approximately 1,500 amp. at 7,500 volts and of the 150-amp. cutout 4,000 amp. at 7,500 volts.

Manhole Oil Circuit Breaker

A manually operated manhole oil circuit breaker, known as the type M-9, especially designed for underground distribution for all voltages up to 7,500, has been placed on the market by the Condit Electrical Manufacturing Corporation, Boston. The breaker is of sturdy, water-tight construction. A strong, rugged frame is used with reinforcing ribs at selected points affording a rigid foundation for the mechanism contact, studs and bushings. The frame is arranged on two sides for either single or multi-conductor cable sleeves.

The tank is of strong, rectangular construction securely bolted at many points to the underside of the frame. Gaskets are provided at all joints, affording water-tight construction. The type M-9 is furnished for automatic or non-automatic operation. For automatic operation a bushing type current transformer and a trip coil per pole are furnished. The breaker is furnished three pole, for 400, 600 and 800 amp. capacity at 7,500 volts, with an estimated interrupting capacity of 3,000 amp. at 7,500 volts.

Fan-Cooled Inclosed Motor

A totally inclosed fan-cooled electric motor of the ball-bearing type has been placed on the market by the Cleveland Electric Motor Company, Cleveland. The new Cleveland "Security" motor is said to eliminate the possibility of dust leakage along the shaft into the windings. The motor is of the double-shell type. The manufacturer states that with this type of motor practically the same rating is obtained for a given frame size as in the open-type motor.

Current-Limiting Reactor

A dry type current-limiting reactor, in which the winding of insulated cable is wound around a hollow concrete cylinder, has been placed on the market by the Westinghouse Electric & Manufacturing Company. A concrete disk, having ventilation openings, is fastened to each end of the concrete cylinder by studs screwed into alloy inserts. The structure is mounted on post type porcelain insulated feet. The windings consist of disk-shaped layers of cable, wound radially so that the electrical stress between layers is very low. The use of copper of large cross-section results in a reactor of low heat losses and low operating temperatures. One end of all cables of the winding is connected to a terminal at the top of the reactor, while the other ends are connected to a terminal at the bottom of the coil, all connections being welded.

Switches with Fog-Type Insulators

A new combination disconnecting switch and fuse unit, equipped with fog-type insulators, has been announced by the Delta-Star Electric Company, Chicago. This combination is said to effect a considerable saving in space which is often of importance in outdoor substation construction. The company also announces a new form of air-break, gang-operated, pole-top switch equipped with fog-type insulators.

HINGED-TYPE FINGER FOR RAILWAY AND INDUSTRIAL HAULAGE CONTROLLERS.—An improved hinged-type finger for railway and industrial haulage controllers has been brought out by the General Electric Company. By employing a smaller radius on the contact tip support it has been made self-aligning, and at the same time the clearance between the contact tip support and the housing has been reduced so as to minimize the up and down movement of the tip on the segment.

RECTIFIERS. — For operating small interconnecting telephone systems, private branch switchboards, etc., the type TM "Kuprox" rectifier has been placed on the market by the Kodel Electric & Manufacturing Company, Cincinnati. All necessary current, both for talking and ringing, is obtained from the rectifier direct from the nearest lamp socket or power circuit. The current is rectified by means of a "Kuprox" metallic disk rectifier and the output is filtered through suitable chokes and condensers to give a uniform, smooth, direct current without any noticeable hum or interference.

ELECTRODE HOLDER.—An electrode holder for metallic arc welding has been placed on the market by the Fusion Welding Corporation, 103d Street and Torrence Avenue, Chicago. The manufacturer claims that the principal cause of electrode overheating, improper contact in the electrode holder, has been obviated in the new "Fuzon" model A holder, which automatically scrapes off any insulating material that may be present on the welding rod and insures four clean points of firm contact, thereby minimizing the overheating of the electrode. The holder is said to have no springs or moving parts and to be of simple construction. The jaws are made of a special copper alloy. It is said to be very light in weight, although substantially constructed, and is balanced so as not to fatigue the welding operator.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 7, 1928)

1,680,117. FUSED SWITCH; J. Sachs, Hartford, Conn. App. filed Aug. 5, 1920.

1,680,129. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; H. W. Brown, Schenectady, N. Y. App. filed Dec. 17, 1924.

1,680,149. SYSTEM OF DISTRIBUTION; W. S. Gould, New York, N. Y. App. filed June 5, 1923.

1,680,189. CONTROLLABLE RESISTANCE DEVICE; H. J. Wiegand, Milwaukee, and H. N. Packard, Wauwatosa, Wis. App. filed Nov. 2, 1923.

1,680,201. BATTERY LEAD CONNECTION OR CLAMP; J. P. Bihl and H. J. Bihl, Newport, Ky. App. filed April 22, 1926.

1,680,210. RECTIFIER ELECTROLYTE; E. W. Engle, Lake Forest, Ill. App. filed Jan. 7, 1927.

1,680,216. ELECTROMAGNETIC INSTRUMENT; W. Herzog, Charlottenburg, Germany. App. filed April 12, 1927.

1,680,225. LIGHTING FIXTURE; M. Luckiesh, Cleveland, Ohio. App. filed Dec. 30, 1925.

1,680,231. CABLE JOINT; D. M. Simons, Osborne, Pa. App. filed Oct. 25, 1926.

1,680,233. ELECTRIC WELDING METHOD AND APPARATUS; A. J. Townsend, Canton, Ohio. App. filed Jan. 18, 1921.

1,680,259. CONTROL SYSTEM; G. L. Spencer, Tinguaro, Matanzas, and V. E. Metcalfe, Delicias, Oriente, Cuba. App. filed Oct. 22, 1924.

1,680,261. BLAST MAGNETO; A. U. Davis, Baltimore, Md. App. filed Nov. 8, 1926.

1,680,271. ARGON-MERCURY DISCHARGE TUBE; R. R. Machlett, New York, N. Y. App. filed July 9, 1927.

1,680,272. LUMINOUS TUBE AND PROCESS OF MANUFACTURING THE SAME; R. R. Machlett, New York, N. Y. App. filed Nov. 17, 1927.

(Issued Aug. 14, 1928)

*1,673,544. FURNACE-CONTROL SYSTEM; J. C. Woodson, East Pittsburgh, Pa. App. filed May 6, 1926.

1,680,311. RECIPROCATING MOTOR; C. S. Weyandt, Pittsburgh, Pa. App. filed Feb. 1, 1926.

1,680,321. TIME-CLOCK INDICATOR; F. E. Crawford, Winchester, Mass. App. filed Aug. 9, 1921.

1,680,326. AUTOMATIC TIME-PRINTING DEVICE; C. S. Dutton, Oakland, Calif. App. filed April 4, 1927.

1,680,379. ELECTRIC HEATING SYSTEM; L. P. Hynes, Albany, N. Y. App. filed Dec. 6, 1924.

1,680,393. PNEUMATIC REVERSING SWITCH; L. G. Riley, Pittsburgh, Pa. App. filed May 4, 1925.

1,680,394. CONTROL APPARATUS; K. A. Simmon, Edgewood Park, Pa. App. filed July 7, 1920.

1,680,395. RELAY SYSTEM; H. P. Sleeper, Wilkinsburg, Pa. App. filed April 11, 1922.

1,680,396. REGULATOR SYSTEM; S. A. Staege, Pittsburgh, Pa. App. filed May 4, 1925.

1,680,397. ELECTRIC STEAM BOILER; H. Stransky, Vienna, Austria. App. filed April 23, 1926.

1,680,398. TEMPERATURE-CONTROL SYSTEM; I. G. Thomas, Mansfield, Ohio. App. filed Nov. 7, 1927.

1,680,400. AUTOMATIC ELECTRIC FLASHER; D. Ulrey and D. I. Mayne, Wilkinsburg, Pa. App. filed June 28, 1923.

1,680,401. CONTROL SYSTEM FOR RADIANT HEATERS; V. G. Vaughan, Wilkinsburg, Pa. App. filed July 20, 1923.

1,680,402. WAFFLE IRON; V. G. Vaughan, Mansfield, Ohio. App. filed May 11, 1927.

1,680,404. HEATING UNIT; J. C. Woodson, Mansfield, Ohio. App. filed May 11, 1927.

1,680,405. MOTOR-OPERATED CIRCUIT INTERRUPTER; W. M. Austin, Swissvale, Pa. App. filed May 12, 1923.

1,680,406. ELECTRIC IRON; C. B. Backer, Brooklyn, N. Y. App. filed Oct. 20, 1927.

1,680,407. INDUCTION FURNACE; P. H. Brace, Wilkinsburg, Pa. App. filed Aug. 29, 1927.

1,680,410. RELAY-TRIPPING SYSTEM; L. N. Crichton, Edgewood, and L. R. Golladay, Wilkinsburg, Pa. App. filed May 24, 1921.

1,680,411. INSULATOR CONNECTER; G. M. Eaton, Pittsburgh, and E. E. Rose, Edgewood, Pa. App. filed July 15, 1919.

1,680,414. MOTOR-CONTROL SYSTEM; R. E. Hellmund, Swissvale, Pa. App. filed Aug. 17, 1920.

1,680,416. MAGNET SWITCH; C. H. Hodgkins, Pittsburgh, Pa. App. filed Jan. 22, 1924.

1,680,418. INCLOSED-SWITCH MECHANISM; O. S. Jennings and F. G. von Hoorn, Mansfield, Ohio. App. filed June 25, 1927.

1,680,419. VARIABLE-SPEED SET; E. Kloss, Falkensee, near Spandau, Germany. App. filed April 30, 1926.

1,680,420. GALVANOMETER; J. W. Legg, Wilkinsburg, Pa. App. filed Sept. 8, 1920.

1,680,426. THERMOSTATIC SWITCH; H. D. Matthews, Mansfield, Ohio. App. filed April 23, 1926.

1,680,428. THERMOSTATIC REGULATOR; A. J. Mottlau, Pittsburgh, Pa. App. filed April 25, 1924.

1,680,429. THERMAL RELAY; A. J. Mottlau, Pittsburgh, Pa. App. filed Sept. 28, 1926.

1,680,465. ELECTRICAL MEASURING INSTRUMENT; C. T. Mason, East Orange, N. J. App. filed July 18, 1925.

1,680,478. MOTOR CONTROLLER; E. W. Seeger, South Milwaukee, Wis. App. filed June 3, 1926.

1,680,482. SIGNAL; C. S. Snavely, Pittsburgh, Pa. App. filed March 8, 1923.

1,680,495. MOTOR CONTROLLER; T. E. Barnum, Wauwatosa, and H. N. Wade, Shorewood, Wis. App. filed Oct. 18, 1920.

1,680,507. APPARATUS FOR MEASURING DISTANCE; H. G. Dorsey, Gloucester, Mass. App. filed Nov. 12, 1925.

1,680,513. FIREPLACE; G. W. Guy, Chicago, Ill. App. filed Jan. 9, 1925.

1,680,568. ELECTRIC SWITCH; J. Pollak, Boston, Mass. App. filed Jan. 2, 1926.

1,680,572. LUMINISCENT TUBE; R. H. Rundle, Burlingame, Calif. App. filed May 31, 1927.

1,680,576. ELECTRIC FIXTURE SUPPORT; W. Symmes, San Francisco, Calif. App. filed Oct. 23, 1922.

1,680,595. CURRENT INDUCTION; A. H. Davis, Jr., Buffalo, N. Y. App. filed Oct. 26, 1925.

1,680,599. PICKER MAGNET; W. R. Edson, Southbridge, Mass. App. filed Jan. 6, 1927.

1,680,606. ELECTRIC-LIGHTING FIXTURE; G. Fread, Enid, Okla. App. filed Feb. 4, 1926.

1,680,621. ELECTRIC HEATING UNIT; A. J. Kercher, Berkeley, Calif. App. filed Oct. 6, 1925.

1,680,622. ELECTRIC WATER HEATER; A. J. Kercher, Berkeley, and W. W. Hicks, San Francisco, Calif. App. filed June 28, 1926.

1,680,630. COMBINED ELECTRODE AND STIRRING DEVICE; S. A. W. Okell, Cranford, N. J. App. filed Jan. 3, 1927.

1,680,656. STORAGE OF DRY CELLS AND BATTERIES; E. B. Wheeler, Midland Park, and J. C. Wright, Millburn, N. J. App. filed June 7, 1924.

1,680,667. ELECTROMAGNETIC DEVICE; A. M. Curtis, East Orange, N. J. App. filed Oct. 3, 1922.

1,680,671. APPARATUS FOR INTERRUPTING ELECTRIC ARCS; O. H. Eschholz, Wilkinsburg, Pa. App. filed April 1, 1922.

1,680,674. ELECTRIC SWITCH; A. S. Fitzgerald, London, England. App. filed Sept. 8, 1924.

1,680,679. HIGH-TENSION UNDERGROUND CABLE; W. C. Hayman, Schenectady, N. Y. App. filed Oct. 25, 1927.

1,680,682. SWITCH GEAR FOR STARTING AND CONTROLLING ELECTRIC MOTORS; J. A. Hirst, Chester, England. App. filed July 18, 1924.

1,680,686. CONTROLLING SYSTEM FOR MOTOR-DRIVEN CLOCKS; S. Keilien, Binghamton, N. Y. App. filed Sept. 14, 1925.

1,680,688. INDUCTION MOTOR; H. Maxwell, Schenectady, N. Y. App. filed Oct. 24, 1923.

1,680,700. ELECTRICALLY-OPERATED CLOCK; M. A. Standow, Newark, N. J. App. filed Aug. 21, 1925.

1,680,701. CONTACT-CONNECTER SHUNT; R. L. Stancliff, Wesleyville, Pa. App. filed April 4, 1927.

1,680,704. TROLLEY FROG; P. G. Swars, Pittsburgh, Pa. App. filed Feb. 19, 1927.

1,680,705. METHOD OF MAKING INSULATORS; E. Thomson, Swampscott, Mass. App. filed Nov. 29, 1922.

1,680,707. SYNCHRONIZING DEVICE; O. C. Traver, Schenectady, N. Y. App. filed Dec. 31, 1925.

1,680,708. RELAY; O. C. Traver, Schenectady, N. Y. App. filed Nov. 24, 1926.

1,680,718. ELECTRIC HEATER; C. C. Abbott, Pittsfield, Mass. App. filed July 5, 1927.

1,680,728. REGULATING SYSTEM; E. Courtin, Berlin, Germany. App. filed June 10, 1927.

1,680,731. MAGNETIC SHUNT FOR DYNAMO-ELECTRIC MACHINES; R. C. Deale, Plainfield, N. J. App. filed April 2, 1926.

Information on foreign patents can be obtained through the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

*Issued June 12, 1928, but omitted in the previous listing for that date.

New Trade Literature

CENTRIFUGAL PUMPS.—Bulletin No. 212 issued by the Pennsylvania Pump & Compressor Company, Easton, Pa., describes the Pennsylvania multi-stage centrifugal pumps, class "OMS."

HEATERS.—H. O. Swoboda, Inc., 3400 Forbes Street, Pittsburgh, has issued bulletin No. 130 covering the "Falcon" specialties for electric ranges. It describes heaters intended for the oven and broiler compartments of electric ranges.

ELECTRIC DUMB WAITER.—A bulletin issued by the Warner Elevator Manufacturing Company, Cincinnati, describes and illustrates the Warner type F-18 electric dumb waiter.

MOTORS, ARC WELDERS, ETC.—The General Electric Company, Schenectady, N. Y., has issued a series of bulletins. They describe and illustrate its totally inclosed motors for portable hoists, type CO-1820 direct-current crane and hoist motors, G. E. high-speed "Built-in" type KT motors, constant-speed induction motors for elevator service, type RKS capacitor motors, type WD-200A arc welder, type AW resistor arc welders, gas-engine-driven arc welder, automatic tank welder, CR7009-B12 across-the-line type of magnetic reversing switch, types RRB and RRC direct-heat electric furnaces, type I-18 watt-hour meters and the form 45H and form 45L "Novalux" suspension units.

RAILWAY SIGNALING EQUIPMENT.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has published circular No. 1787, describing and illustrating complete electrical equipment from automatic switching to wiring devices for railway signaling, automatic switching equipment, disconnect switches, type S and SK transformers, autovalve lightning arresters, choke coils, fuses, cutouts, porcelain insulators, materials used in wiring and insulating and a full line of testing and recording instruments.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Johannesburg, South Africa (No. 32,958), for electrical advertising devices.

Purchase is desired in Hull, England (No. 32,990), of electric carpet-cleaning and washing machines.

Purchase and agency are desired in Helsingfors, Finland (No. 32,986), for electrical cooking and heating appliances and electric wiring devices.

An agency is desired in Santiago, Chile (No. 32,871), for flashlights and batteries.

A sole agency is desired in Geneva, Switzerland (No. 32,887), for electrical heating apparatus.

Purchase or agency is desired in Manchester, England (No. 32,988), for household electrical appliances.

A sole agency is desired in Melbourne, Australia (No. 32,972), for household electrical appliances, especially dish washers, refrigerators, stoves and washing machines.

An agency is desired in Cologne, Germany (No. 32,870), for electric meat choppers and coffee mills.

Purchase and agency are desired in Rosario, Argentina (No. 32,907), for electric luminous signs.

Purchase and agency are desired in Durban, South Africa (No. 32,991), for electrical stoves.

An agency is desired in Purmerend, Netherlands (No. 32,893), for electric washing machines.

Purchase or agency is desired in London, England (No. 32,989), for underground and overhead transmission wires.

Any manufacturer desiring to establish agencies abroad may consult with the nearest district office of the Bureau of Foreign and Domestic Commerce, Department of Commerce, where data on available agencies throughout the world are on file.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

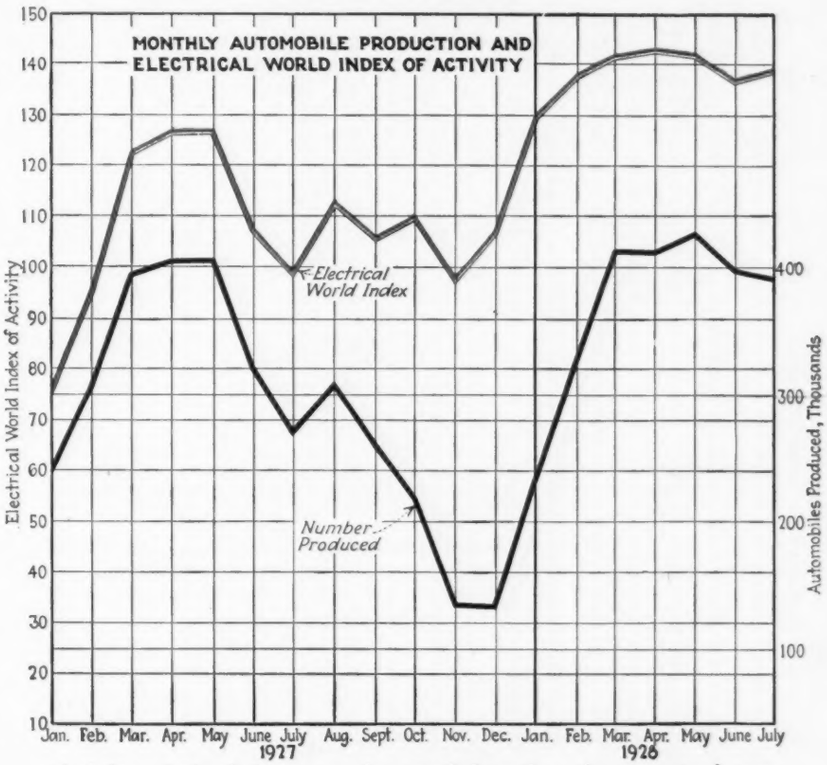
Electrical Energy Consumption Measures Automobile Industry

THE automobile industry affords an excellent opportunity for measuring productive activity by energy consumption. It is relatively new. It is highly mechanized, and most of its power is applied electrically. An instantaneous measure of the rate at which energy is being used is therefore available. This measure takes account not only of the production of cars but of parts as well. The distinction is important. Output of cars does not necessarily measure the industrial activity in a given month. Advantage may be taken of months low in car sales to build up a stock of parts for replacements. The energy consumption tells the story.

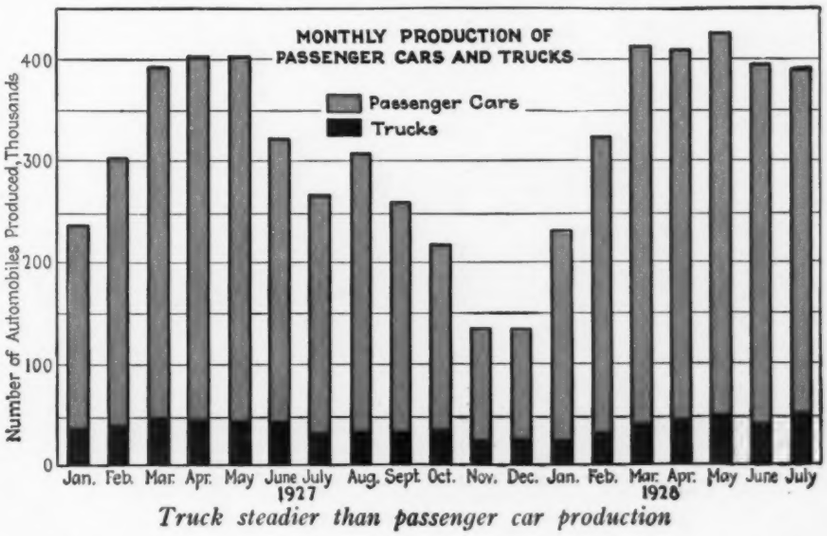
The degree to which electrical power is used in automobile production is revealed by the Census of Manufactures for 1925, the latest at present available. Combining data for motor vehicles and for bodies and parts, the total primary horsepower amounts to 1,172,013 hp. Of this, 808,656 hp. is in motors operated on purchased energy. The remaining 363,357 hp. is almost entirely in steam engines and turbines. This, however, does not signify direct mechanical drive, for the power installation includes 257,547 kw. of generators—enough to require virtually all the steam power mentioned. To this generator capacity is connected 358,542 hp. in motors.

The chart shows the seasonal fluctuation in output of new cars. It shows a similar fluctuation in energy consumption. But the variations in the latter are far less violent. From the car output, considered alone, widespread unemployment during several months of the year might be inferred. The index based on energy consumption fails to support such an inference. It does indicate greater production in summer than in winter by a considerable margin, but the deep valleys have been filled; even in the two least active months the energy barely falls below the monthly average for the years 1923-1925, taken as the base (100) for index purposes. While the monthly output since the beginning of 1927 has varied between a minimum of 133,579 vehicles in December, 1927, and a maximum of 426,101 in May, 1928, a difference equal to nearly 220 per cent of the former number, the high point of the energy index is only 47 per cent above the low.

In this comparison no adjustment has been made for the number of working days in the month. The index and production curves are therefore comparable, but the average daily car output or energy consumption is not directly comparable for different months unless the length of the working month is taken into account. The index also pictures the annual power load curve of the industry.



Activity of the industry varies much less than the output of cars



Truck steadier than passenger car production

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.

High Summer Operations in the Middle Atlantic States

MANUFACTURING plants in the Middle Atlantic States have witnessed an unusually high rate of operations since the opening of the year, and especially during the summer months. The rate of general industrial operations in this section during July was only about 3 per cent under that of March, while the summer curtailment during the past five years has averaged around 17 per cent under the March rate of operations. It appears, however, that industrial conditions in the Middle Atlantic States during the current summer are slightly better than those characterizing industry in the nation.

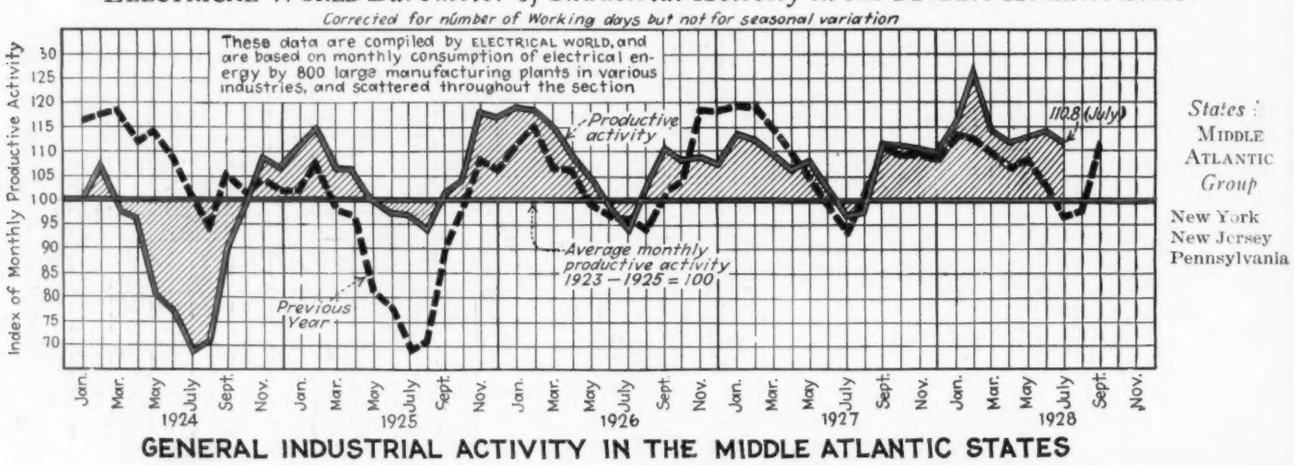
During July only two of the section's leading industrial groups—ferrous and non-ferrous metal-working plants and the paper and pulp group—reported a rate of operations under those of last year. All the other groups reported material gains over July, 1927. Of special interest is the fact that while in the nation as a whole the textile industry reported July operations some 19 per cent under last year, in the Middle Atlantic States this group was operating at a rate 18 per cent above last year. On the other hand, metal-working plants in the section reported July operations 1.7 per cent under 1927, while in the nation these plants were operating on a plane 21 per cent above July last year.

Indexes of Productive Activity in the Middle Atlantic States

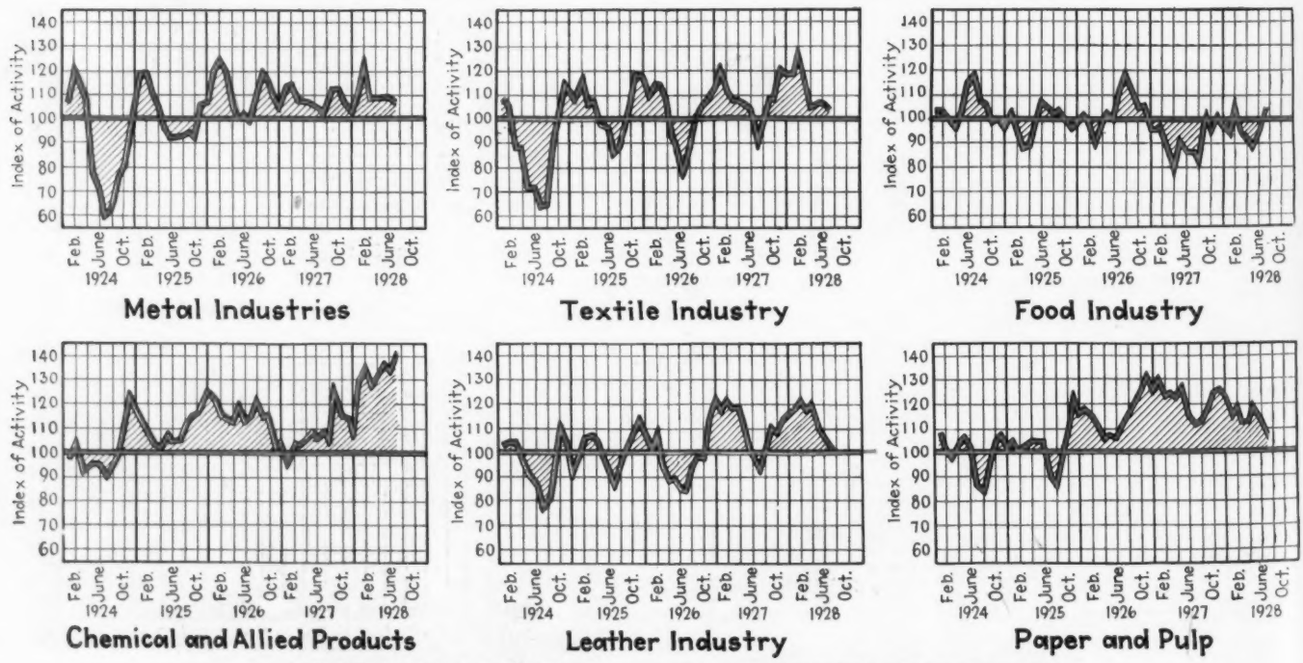
All Figures Adjusted for Number of Working Days

	July, 1928	June, 1928	July, 1927	Average First Seven Months 1928	Average First Seven Months 1927
All industries	110.8	113.4	96.0	115.1	106.9
Automobile, including parts	172.8	188.4	80.2	171.9	90.2
Chemicals and allied products	141.8	133.0	109.5	133.5	104.7
Food and kindred products	101.9	93.8	85.6	95.2	.....
Leather and its products	100.1	105.2	91.9	113.3	110.6
Lumber and its products	126.0	102.1	123.2	108.5	.....
Metals group	108.2	109.7	102.9	111.5	108.3
Rolling mills and steel plants	110.7	106.2	98.4	111.7	107.5
Metal-working plants	105.4	113.4	107.4	111.2	.....
Paper and pulp	105.5	111.8	111.8	113.8	123.3
Stone, clay and glass	134.2	132.8	104.0	113.2	.....
Textiles	102.9	105.2	87.2	111.6	106.2

ELECTRICAL WORLD *Barometer of Industrial Activity in the Middle Atlantic States*


Corrected for number of Working days but not for seasonal variation
These data are compiled by ELECTRICAL WORLD, and are based on monthly consumption of electrical energy by 800 large manufacturing plants in various industries, and scattered throughout the section
Index of Monthly Productive Activity
Productive activity
110.8 (July)
Average monthly productive activity 1923 – 1925 = 100
Previous Year
States: MIDDLE ATLANTIC Group
New York
New Jersey
Pennsylvania
1924
1925
1926
1927
1928

GENERAL INDUSTRIAL ACTIVITY IN THE MIDDLE ATLANTIC STATES



PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE MIDDLE ATLANTIC STATES